IS NEGATIVE SELF-TALK ALL THAT BAD? EXAMINING THE
MOTIVATING FUNCTIONS OF NEGATIVE SELF-TALK

by

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ABSTRACT

The purpose of this study was to investigate the motivational function of negative self-talk (ST). One suggestion is that negative ST is motivational when it is interpreted as a challenge. For example, an athlete may say, “my legs are tired” and challenge it by saying “but I can push through it.” This study examined the potential motivating functions of challenging negative ST on a 20-minute cycling task. Participants (n = 93) participated in one of four ST interventions: a) positive, b) negative, c) neutral, or d) negative-challenging. Overall, there were no between-group differences on task performance. However, a significant group by time interaction effect was present, where the challenging group outperformed the negative group in the final stage of the task. The findings suggest that time within an endurance task is a moderator of the ST-performance relationship, and this study provides initial evidence for implementing challenging ST techniques.
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TABLE OF CONTENTS

ABSTRACT ................................................................................................................................. ii
ACKNOWLEDGEMENTS ............................................................................................................... iii
TABLE OF CONTENTS .................................................................................................................. iv
LIST OF TABLES ........................................................................................................................... vii
LIST OF FIGURES ......................................................................................................................... viii
CHAPTER 1 .................................................................................................................................. 1
INTRODUCTION ............................................................................................................................ 1
  1.1 Background Information ........................................................................................................ 1
  1.2 Purpose of the Study ............................................................................................................... 3
  1.3 Hypotheses .......................................................................................................................... 3
  1.4 Significance .......................................................................................................................... 4
    1.4.1 Impact on academic research interests ....................................................................... 4
    1.4.2 Impact on athletes and consulting practitioners ......................................................... 5
  1.5 Operational Definitions ........................................................................................................ 5
CHAPTER 2 .................................................................................................................................. 7
REVIEW OF THE LITERATURE .................................................................................................... 7
  2.1 Description of Athletes’ Self-Talk ........................................................................................ 7
    2.1.1 Defining self-talk ........................................................................................................ 7
    2.1.2 Descriptive research ................................................................................................. 8
  2.2 Self-Talk and Sport Performance ......................................................................................... 9
    2.2.1 Field studies ............................................................................................................. 9
    2.2.2 Experimental studies .............................................................................................. 10
2.2.2.1 Positive and negative self-talk .............................................................. 11
2.2.2.2 Motivational and instructional self-talk ................................................ 12
2.3 Underlying Mechanisms of Self-Talk ........................................................... 16
  2.3.1 Cognitive mechanisms ........................................................................... 17
  2.3.2 Behavioral mechanisms ........................................................................ 18
  2.3.3 Affective mechanisms .......................................................................... 19
  2.3.4 Motivational mechanisms ..................................................................... 21
2.4 Negative Self-talk and Performance Improvement ......................................... 22
2.5 Conclusion .................................................................................................. 23

CHAPTER 3 ........................................................................................................... 25
METHODOLOGY ................................................................................................. 25
  3.1 Participants .................................................................................................. 25
  3.2 Task and Dependent Variables .................................................................. 25
  3.3 Self-Talk Conditions ................................................................................ 26
  3.4 Measures and Procedures ......................................................................... 27
    3.4.1 Phase 1. .............................................................................................. 27
    3.4.1.2 Predictive VO₂max test ................................................................. 27
    3.4.2 Phase 2 .............................................................................................. 28
      3.4.2.1 Self-talk plan .............................................................................. 28
      3.4.2.2 Cycling task .............................................................................. 29
      3.4.2.3 Manipulation check ..................................................................... 29
  3.5 Data Analysis .............................................................................................. 30

CHAPTER 4 ........................................................................................................... 33
RESULTS .................................................................................................................................................. 33

4.1 Group Stratification.................................................................................................................................. 33

4.2 Manipulation Check.................................................................................................................................. 34

4.3 Main Analyses.......................................................................................................................................... 35

4.3.1 Overall cycling task performance ....................................................................................................... 35

4.3.2 Cycling performance by time ............................................................................................................... 37

CHAPTER 5 ............................................................................................................................................... 43

DISCUSSION .............................................................................................................................................. 43

5.1 Overall Cycling Performance................................................................................................................... 43

5.2 Cycling Performance Across Time Blocks ............................................................................................. 44

5.4 Sex Differences ..................................................................................................................................... 49

5.5 Defining Negative Self-Talk.................................................................................................................... 50

5.6 Limitations ............................................................................................................................................. 52

5.7 Future Considerations ............................................................................................................................ 53

5.8 Practical Implications ............................................................................................................................... 55

CHAPTER 6 ............................................................................................................................................... 56

CONCLUSION ............................................................................................................................................. 56

REFERENCES ............................................................................................................................................. 57

APPENDIX 1: ETHICS - Informed Consent Form, PAR-Q, Debrief ......................................................... 61

APPENDIX 2: SELF-TALK USE SCALE .................................................................................................... 65

CURRICULUM VIATE
LIST OF TABLES

Table 1: Stratification of Predicted VO₂ max by Group for Males and Females........33
Table 2: Manipulation Check Data by Group.................................................. 35
Table 3: %Predicted VO₂ max and Overall Distance by Group.......................... 36
Table 4: Distance Covered in Kilometers Each Time Block by Group...............39
LIST OF FIGURES

Figure 1: 95% Confidence Intervals for Percent Difference in Overall Distance……36

Figure 2: Distance Covered Each Time Block by Sex………………………………………38

Figure 3: Distance Covered in Each Time Block by Group…………………………….40

Figure 4: 95% Difference Confidence Intervals by Time Block………………………….41

Figure 5: Self-talk Dissonance in the Final Time Block…………………………………47
CHAPTER 1
INTRODUCTION

1.1 Background Information

Sport is competitive by nature. It is one athlete or team of athletes competing against another. Many athletes spend countless hours practicing and training to become great at what they do. Clearly athletes work towards improving their physical skills, but there is a mental component to sport that cannot be overlooked. Michael Jordan, arguably the best basketball player of all time, stressed the importance of the mental game in sport by saying, “the mental part is the hardest part and I think that's the part that separates good players from the great players” (NBA, 2001).

Sport psychologists work with athletes to develop the “mental part” of sport, similar to how a personal trainer works to improve athletes’ physical fitness. This involves helping athletes to maintain focus, build confidence, and feel motivated. To accomplish this, sport psychologists use several tools and techniques; one tool that is frequently used is self-talk (ST). As a mental skill, ST involves developing cue words or phrases to help an athlete regulate their internal dialogue (Zinsser, Bunker, & Williams, 2010). The self-dialogue an athlete has with himself or herself can be distracting, negative, and/or anxiety provoking (Theodorakis, Weinberg, Natsis, Douma, & Kazakas, 2000). However, it can also be harnessed to build confidence, regulate arousal, focus attention, and provide motivation (Hardy, Oliver, & Tod, 2009).

Many ST techniques promote the use of positive ST and aim to eliminate an athlete’s negative ST. For example, an athlete may automatically say, “I suck” after making a mistake. A sport psychologist can help an athlete identify how this negative
thinking impacts the athlete’s performance, and collaborate with the athlete to promote a more positive approach. One example would be to use a technique named countering. Countering allows an athlete to rationalize against negative ST using facts. For example, that athlete saying “I suck” may counter by saying “Coach wants me on the field, so I must be talented” (Zinsser et al., 2010).

Although there is considerable support for the use of positive ST to enhance performance, the relationship between negative ST and performance is unclear (Tod, Hardy, Oliver, 2011). When examining observable ST during a tennis match, Van Raalte, Brewer, Rivera, and Petitpas (1994) found that negative ST was associated with losing. Additionally, Harvey, Van Raalte, and Brewer (2002) found that the more negative ST a golfer reported using, the worse their performance. However, Van Raalte, Cornelius, Brewer, and Hatten (2000) were unable to find an association between winning or losing and negative ST use in tennis. Furthermore, in their multiple baseline design, Hamilton, Scott, and MacDougall, (2007) found that two out of three participants in a negative ST condition actually improved their performance on an endurance cycling task.

It may appear counterintuitive that negative ST can have a beneficial impact on performance, however, some athletes have reported that their negative ST is motivational (Hardy, Hall, & Alexander, 2001). Goodhart (1986) explained that negative ST could actually encourage an individual to try harder in order to avoid a negative outcome. For example, if an individual thought, “last time I did this I sucked”, they may increase their effort to avoid another negative outcome. Van Raalte and colleagues (1994) suggested that negative ST might be motivational by reflecting an athlete’s own self-confidence. For example, some athletes may say to themselves, “that was an awful play” and translate
the meaning into, “I can make better plays”. Furthermore, Hamilton and colleagues (2007) put forth the idea of challenging ST, where negative ST can be viewed as a challenge and thus provide motivation to an athlete.

After failing to find a relationship between negative ST and losing in competitive tennis, Van Raalte and colleagues (2000) highlighted the interpretive nature of ST and suggested that ST can affect different people in different ways. For some, it may hinder performance, and for others it may serve a motivational function. Hamilton and colleagues (2007) also highlighted the interpretative nature of ST, and suggested that the interpretation of ST might be more important than the content of the ST itself.

Evidently, there is a need to clarify the relationship between ST valence and performance, specifically with regards to negative ST. It appears that negative ST can motivate some athletes and impair the performance of others. Given that research participants in negative ST conditions all receive the same intervention, it is plausible that athletes interpret negative ST differently, and the interpretation of ST is associated with the varying performance effects.

1.2 Purpose of the Study

The purpose of this study is to gain a better understanding of the motivational function of negative ST. Specifically, this study will compare the performance effects of four different ST interventions on a 20-minute cycling task. The four ST interventions will be positive ST, negative ST, neutral ST, and challenging ST.

1.3 Hypotheses

To fulfill the purpose of the study, the following null hypotheses will be tested:
1. There will be no significant differences between ST groups in the percentage of predicted VO$_2$max they exercise at during a 20-minute cycling task.

2. There will be no significant differences between ST groups in the distance cycled during a 20-minute cycling task.

3. There will be no significant interaction effect between ST group and time on the distance cycled.

1.4 **Significance**

This study will provide insight to guide both researchers and applied sport psychologists who are interested in the applications of ST as a mental skill. By examining the role of various forms of ST, this study will help researchers understand the motivational properties of negative ST, and help applied sport psychologists design their interventions accordingly.

1.4.1 **Impact on academic research interests.** It is established that ST can improve athletic performance (Hatzigeorgiadis, Zourbanos, Galanis, & Theodorakis, 2011). However, there are inconsistent findings in the negative ST-performance relationship (Tod et al., 2011). Some studies have found negative performance to be associated with the use of negative ST (Harvey et al., 2002; Van Raalte et al., 1994), while others have found the performance effects to be neutral (Van Raalte et al., 2000), or even positive (Hamilton et al., 2007) following the use of negative ST. It is suggested that individuals who benefit from negative ST interpret the negative self-directed statements as motivational (Van Raalte et al.; Hamilton et al.). This study will help clarify the inconsistent results in the existing ST literature by determining if challenging negative ST is a mechanism in which individuals can be motivated by negative ST.
1.4.2 Impact on athletes and consulting practitioners. Applied sport psychologists often include ST techniques in their mental skills training programs. Various techniques such as thought stopping, thought replacement, and countering, eliminate the use of negative ST and replace it with positive ST. However, knowing that some athletes benefit from negative ST suggests that learning to use negative ST in a motivational manner may also be a useful ST technique. This study will determine if learning to restructure negative ST as a challenge can be a beneficial approach for applied sport psychologists to use when working with athletes. Similarly, the knowledge gained from this study can help exercisers by determining which cue words work best for endurance activities.

1.5 Operational Definitions

Self-talk - “(a) verbalizations or statements addressed to the self; (b) multidimensional in nature; (c) having interpretive elements associated with the content of statements employed; (d) is somewhat dynamic; and (e) serving at least two functions; instructional and motivational, for the athlete” (Hardy, 2006).

Positive ST: ST that is perceived to be motivational, with content that is “encouragement or talk that one can be successful.” (Hardy, Gammage, & Hall, 2001, p.312). For example, “I am doing great.”

Negative ST: ST that is perceived to be discouraging, with content that is “self-critical or represents an inability to succeed.” (Hardy et al., p.312). For example, “I can’t do this.”

Neutral ST: ST with content that is related to the task, but is “non-performance related.” (Barwood, Corbett, Wagstaff, McVeigh, &. Thelwell, 2015). For example, “I am on a bike.”
**Challenging ST:** ST with negative content that is then “interpreted as a challenge.”

(Hamilton et al., 2007). For example, “My legs are tired, but I am going to push through it.”
CHAPTER 2

REVIEW OF THE LITERATURE

2.1 Description of Athletes’ Self-Talk

2.1.1 Defining self-talk. ST is defined as self-addressed statements or verbalizations that are interpreted according to their content. These statements are multidimensional, dynamic, and serve at least motivational and instructional functions (Hardy, 2006). Furthermore, ST encompasses self-directed statements that are used systematically as a mental skill, as well as statements that are inherent or automatic (Hardy, Oliver et al., 2009).

Two classifications of ST are evident in the sport psychology literature. The first classification separates positive ST and negative ST. In terms of content, positive ST provides encouragement (Hardy, Gammage et al., 2001) and praise (Moran, 1996) and negative ST delivers criticism (Hardy; Moran). The valence of ST has also been described according to the positive and negative effects ST has on performance. According to performance effects, positive ST helps an athlete maintain focus on the present, rather than dwell on past mistakes or think about the future (Weinberg, 1988). Alternatively, negative ST is inappropriate, irrational, counterproductive and anxiety producing (Theodorakis et al., 2000).

The second major classification of ST categorizes ST as instructional or motivational depending on the function it serves the athlete. Instructional ST can be subdivided into cognitive specific and cognitive general. Cognitive specific ST helps athletes execute and develop skills; cognitive general ST assists tactical execution and general performance improvement. Motivational ST can be subdivided into mastery,
arousal, and drive. Motivational mastery ST builds confidence, and helps an athlete stay focused. Motivational arousal ST is that which helps an athlete relax, or increase arousal. Finally, motivational drive ST assists athletes in regulating effort and working towards their goals (Hardy, Gammage et al., 2001).

2.1.2 Descriptive research. Hardy, Gammage, and colleagues (2001) described the 4 “Ws” (what, where, when, why) of athletes’ ST. According to their results, the “what” or content of athletes’ ST includes valence (positive, negative), perspective (overt, covert), person (first, second), and structure (cue word, phrase, sentence). The places “where” athletes use ST include practice, competition, and outside of the sporting environment. “When” athletes use ST is during, before, and after practice and competition. The reason “Why” athletes use ST is for motivational and instructional purposes.

Hardy, Hall, and Hardy (2005) extended the qualitative descriptive findings of Hardy, Gammage and colleagues (2001) using a quantitative approach. According to the results, athletes tend to use a covert ST perspective, structure their ST with cue words and phrases rather than complete sentences, and engage in more positive ST than negative or neutral ST. Additionally, ST is used more frequently by athletes in competition than in practice, and more during competition/practice than beforehand or afterwards. In another related study, it was determined that athletes’ use of ST increases throughout the span of a season (Hardy, Hall, and Hardy, 2004).

Not only does the use of ST vary according to the time and place, it can vary according to the athlete. Hardy and colleagues (2004; 2005) determined that athletes who participate in individual sports use ST more often than athletes of team sports. As well,
Hardy and colleagues (2004) found that greater skilled athletes engaged in more ST, and used ST in a more planned and consistent manner than their lesser skilled counterparts. The researchers suggested that it would be beneficial for sport psychologists to promote planned ST, and that ST may be learned and improved over time.

2.2 Self-Talk and Sport Performance

Athletes naturally engage in ST and many sport psychologists teach athletes how to use ST in an attempt to improve the athlete’s performance. As a mental skill, ST involves the strategic use of cue words or phrases in order to regulate cognitions, emotions, and behaviors (Zinsser et al., 2010). A recent meta-analysis indicated that these interventions can facilitate learning and performance, with a moderate effect size for ST on performance (0.48; Hatzigeorgiadis et al., 2011). Additionally, a systematic review of 47 studies supported the performance enhancing effects of instructional, motivational, and positive ST (Tod et al, 2011).

2.2.1 Field studies. Early studies investigating the relationship between ST and performance compared the use of ST from higher skilled athletes to their lower skilled counterparts. In an exploratory study, Mahoney and Avener (1977) compared the ST frequency between qualifying and non-qualifying gymnasts at an Olympic team trial. The qualifiers reported “talking to themselves” more frequently than non-qualifiers. In a similar study, Highlen and Bennett (1983) compared ST between Pan American qualifiers and non-qualifiers across an open-skill (wrestling) and closed-skill sport (diving). Qualifying divers reported using more ST in competition and practice than non-qualifiers. During competition, qualifying divers preferred using instructional ST, whereas non-qualifiers reported using more positive ST in the form of praise. For
wrestlers, both qualifiers and non-qualifiers reported using ST moderately in practice and competition and that during competition they use more instructional ST than positive ST. However, qualifying wrestlers reported using more negative ST in the form of criticism during competition than non-qualifiers. Overall, divers and wrestlers did not differ in their use of ST.

Rather than compare qualifiers from non-qualifiers, Van Raalte and colleagues (1994) investigated tennis match outcomes as a correlate of athletes’ positive and negative ST. Van Raalte and colleagues observed the use of overt ST and sport gestures during tennis matches. The findings revealed that match winners and losers did not differ in their use of positive ST but negative ST was associated with poor performance. The researchers suggested that athletes might use positive ST more covertly, so that it may not have been accurately measured.

In a second study observing overt ST and tennis performance, the relationship between negative ST and poor performance was not replicated (Van Raalte et al., 2000). Even in the initial study by Van Raalte and colleagues (1994) some athletes who used negative ST did win their matches. The researchers suggested that some athletes might use negative ST in a motivational manner. For example, athletes who tell themselves “that was an awful play” may be motivated to improve for the next play.

2.2.2 Experimental studies. In addition to field studies (Van Raalte et al., 1994; Highlen & Bennett, 1983; Mahoney & Avener, 1977), there is experimental evidence that supports the use of ST as a mental skill. Experimental research examining the effectiveness of different types of ST on various tasks has shown performance improvements in a variety of activities including swimming (Hatzigeorgiadis, Galanis,
Zourbanos, & Theodorakis, 2014), water-polo throwing tasks (Hatzigeorgiadis, Theodorakis, & Zourbanos, 2004), a soccer accuracy task and a badminton service task (Theodorakis et al., 2000).

2.2.2.1 Positive and negative self-talk. Comparing the effects of positive and negative ST on performance was of particular interest to earlier researchers in the field. Van Raalte and colleagues (1995) compared the dart performance of participants who were assigned to use a positive, neutral, and negative phrase out loud before throwing each dart. The participants who were assigned to the positive ST condition significantly outperformed those in the neutral and negative ST conditions and there were no performance differences between the two latter groups on the fine motor skill.

The use of positive and negative ST also impacts endurance performance. Hamilton and colleagues (2007) used a multiple-baseline design to examine the effectiveness of positive self-regulated, positive assisted, and negative assisted ST on a cycling task. In the assisted ST conditions, the participants listened to a recording that contained the particular type of ST that the participant was assigned. All groups improved their performance following the ST intervention, with the positive assisted ST showing the greatest increase in endurance performance. Given that participants who used negative ST improved performance, the researchers suggested that negative ST serves a motivational function for some participants.

Although the majority of research suggests that positive ST can enhance performance (Tod et al., 2011), some studies have failed to show similar performance enhancing effects. For example, participants using positive, negative, or no ST did not differ in golfing accuracy or consistency (Harvey et al., 2002). As for negative ST, the
findings are equivocal and suggest that negative ST does not have a detrimental impact on performance (Tod et al.).

2.2.2.2 Motivational and instructional self-talk. Rather than classify ST as either positive or negative, the majority of contemporary research has examined and compared the effects of instructional and motivational ST. The purpose of motivational ST is to promote effort (e.g., “all out”), increase confidence (e.g., “I can do it”), encourage a positive mood (e.g., “I feel great”), and regulate activation levels (e.g., “let’s go”). The purpose of instructional ST is to facilitate proper attentional focus (e.g., “see the ball”), and provide instruction to assist with the technical (e.g., “knees bent”) and tactical execution (e.g., “serve deep”) of a skill (Hardy, Gammage et al., 2001). However, motivational and instructional ST could technically be classified as forms of positive ST because they provide encouragement and direct attention.

In one of the first studies to compare the effects of motivational and instructional ST, Theodorakis and colleagues (2000) suggested that the best type of ST to use depends on the nature of the task. To test this matching hypothesis the researchers compared the effects of motivational and instructional ST on a soccer accuracy task, a badminton serving task, a sit up task, and a knee extension task. Given that motivational ST aims to increase effort and positive mood, the researchers hypothesized that this form of ST would have a greater performance effect for the tasks involving strength and endurance (i.e., sit ups, knee extension). Additionally, the researchers predicted that instructional ST would be more effective for the tasks that require precision, skill, and timing (i.e., soccer accuracy and badminton serving) because the purpose of instructional ST is to assist with the proper execution of movement and to focus attention appropriately for the task. The
results of the study partially supported the hypotheses; in the two tasks requiring precision and accuracy, the instructional group improved their performance more than the motivational and control groups. However, for the power and endurance task, motivational ST did not enhance performance more than the other groups. For the sit up task that was based on endurance, the performance was similar among all three conditions. For the knee extension task that was based on power, both forms of ST were equally greater for performance than no ST.

Hatzigeorgiadis and colleagues (2004) also compared the effectiveness of motivational and instructional ST on tasks with different motor demands. The participants completed a precision and power water-polo throwing task. In the precision task, the objective was to hit a target, and in the power task, the goal was maximum distance. In the precision task both ST conditions demonstrated greater performance improvements compared to a control group, with the instructional group improving more. For the power task, only the motivational ST group significantly improved their performance. Overall, the results provided partial support that the best type of ST to use depends on the task.

Partial support for the proposed matching hypothesis was also provided by a recent meta-analysis. The results of the meta-analysis suggested that instructional ST is more effective for fine motor tasks than gross motor tasks and that instructional ST improves performance more than motivational ST for fine motor tasks. Additionally, for gross motor skills, motivational and instructional ST assists performance to the same degree (Hatzigeorgiadis et al., 2011).

Although there appears to be some evidence indicating a matching hypothesis
between task demands and the optimal type of ST to use, it is inconsistent. Studies often find partial support, and some have found no difference between the effects of motivational and instructional ST. For example, Weinberg, Miller, and Horn (2012) compared the effects of motivational and instructional ST in cross-country runners and found that motivational ST and instructional ST were equally effective in improving performance.

Zourbanos, Hatzigeorgiadis, Bardas, and Theodorakis (2013) proposed a second matching hypothesis based on the novelty of the task. The researchers hypothesized that instructional ST would be better suited for a novel task because in the early stages of learning individuals pay attention to and consciously control the movement of the skill. Alternatively, the researchers thought that motivational ST would be better suited for a well-learned task, because individuals at this stage of learning usually perform movements automatically. To test this matching hypothesis the researchers evaluated dominant (well-learned) and non-dominant (novel) handball throwing in 10-12 year olds. Overall, motivational and instructional ST groups improved on both tasks compared to a control group. For the novel task, the instructional ST group improved their performance more than the motivational ST group. For the well-learned task there were no significant differences, but the results were in the expected direction. Overall, the results provided partial support for this second matching hypothesis, thus warranting further investigation.

Hardy, Begley, and Blanchfield (2015) extended the findings of Zourbanos and colleagues (2013) by using skilled adult athletes rather than children in physical education classes. The task used in the experiment was Gaelic football free kick goal accuracy. Using a sport specific skill and skilled athletes made the investigation more
applicable to competitive athlete populations. Similarly, to the study by Zourbanos and colleagues, the participants executed the skill with both the dominant and non-dominant limb. The study utilized a repeated measures design where all of the participants completed the kicks with their left foot and right foot, and with each foot they used instructional and motivational ST. When using their dominant foot, the athletes performed significantly better by using motivational ST than instructional ST and when using their non-dominant foot there were no significant differences. However, the trend for the non-dominant foot was in the expected direction with better performance following the use of instructional ST. Taken together, the findings from the two studies (Zourbanos et al., 2013; Hardy et al., 2014) indicate that the skill level of the athlete is important to consider when developing ST plans.

Another important consideration for ST plans, particularly when used to improve endurance task performance, may be the time within the task. Initial evidence examining the various points within an endurance task suggest that motivational ST may have a stronger effect as the task progresses (Barwood et al., 2015). Given that motivational ST is used to promote effort, regulate mood, and increase confidence (Hardy, Gammage et al., 2001), it may be very suitable to use in the final stages of an endurance task when an individual is in a state of fatigue.

After teaching both instructional and motivational ST to skilled swimmers, Hatzigeorgiadis and colleagues (2014) gave them the choice of which type of ST they would use in a competition. Of the 21 participants in the intervention, 18 chose motivational ST, two chose a combination of motivational and instructional ST, and only one participant chose to use only instructional ST. Although this does not demonstrate
that motivational ST is better for skilled athletes than instructional ST, it does indicate that skilled athletes in swimming prefer to use motivational ST over instructional ST.

Overall, there is both field (e.g., Van Raalte et al., 1994; Highlen & Bennett, 1983; Mahoney & Avener, 1977) and experimental (e.g., Van Raalte et al., 1995; Theodorakis et al., 2000) evidence to support the use of ST techniques to improve athletic performance. Although it is generally supported that ST improves performance, there are still some inconsistencies in the results that warrant further investigation into the ST-performance relationship.

2.3 Underlying Mechanisms of Self-Talk

Although it is established that ST can enhance task performance, there is a lack of research on the mechanisms that explain how ST improves performance (Tod et al., 2011). In their conceptual framework for the study of ST, Hardy, Oliver and colleagues (2009) proposed that ST impacts performance through cognitive, motivational, affective, and behavioral mechanisms. In a systematic review of the literature Tod and colleagues (2011) assessed these mechanisms as mediators to the relationship of ST and performance. The results indicated consistent support for the effect of ST on cognitive and behavioural factors and no clear relationship between ST and motivational and affectual variables.

Furthermore, Hardy, Oliver and colleagues (2009) suggested that the cognitive, motivational, behavioural and affective mechanisms are likely to work together to bring about performance effects. In fact, athletes often report that their ST serves more than one function (e.g., Miles and Neil, 2013; Hatzigeorgiadis, Zourbanos, & Theodorakis, 2007; Chroni, Perkos, & Theodorakis, 2007).
2.3.1 **Cognitive mechanisms.** Hardy, Oliver and colleagues (2009) used the term cognitive mechanisms to identify the attentional control and information processing functions of ST. In their qualitative study, Hardy, Gammage and colleagues (2001) asked athletes why they use ST, and the most frequent response was to maintain focus. Miles and Neil (2013) explored elite cricketers’ use of ST and found that ST was used for attentional purposes. The researchers explained that when the cricketers go up to bat they focus on the positioning of opposing fielders and then switch their focus to the ball. One athlete described using the instructional cue word “ball” to help him focus on the ball, thus providing support that ST can help direct attention to appropriate task stimuli.

The cognitive functions of ST have also been noted in studies using ST interventions. Hatzigeorgiadis and colleagues (2007) asked athletes about the function of their ST following a five-day ST intervention and the participants reported that the major function of ST was to enhance attention. This was true for participants using motivational ST and instructional ST. Perkos, Theodorakis, and Chroni (2002) implemented a 12-week ST intervention for novice basketball players to improve their shooting, passing and dribbling. After the intervention, the participants who used ST improved their passing and dribbling significantly more than those in a control condition. Throughout the intervention the athletes stated that the use of ST improved their concentration. Chroni and colleagues (2007) also compared the perceived functions of motivational and instructional ST in the same three basketball skills. The participants reported that both motivational and instructional ST helped them concentrate better.

Rather than ask athletes how ST improved their performance, Hatzigeorgiadis and colleagues (2004) examined the effect of ST on thought content. They measured the
occurrence of interfering thoughts that the participants experienced during task execution. The tasks were a precision and power based task, and the participants were assigned to either a motivational ST group or an instructional ST group. From the baseline to experimental assessments, all experimental groups significantly decreased the frequency of interfering thoughts and there were no changes in the control groups. Performance also increased from baseline measurement to the experimental measurement for all experimental groups, and the increases in performance were correlated with the decreases in interfering thoughts. Overall, the results provide support for the notion that ST can improve concentration.

2.3.2 Behavioral mechanisms. Hardy, Oliver and colleagues (2009) suggested that ST might influence performance through changing movement patterns. Subjective ratings of performance have provided preliminary evidence that ST influences movement patterns. For example, Anderson, Vogel, and Albrecht (1999) compared the effectiveness of instructional ST, a demonstration, and traditional teaching in helping grade three students learn proper form for the overhand throw. Before the start of the three-week intervention, none of the students had executed the overhand throw with mature form. After the intervention period the instructional ST group performed the overhand throw with significantly better form than the two other groups, indicating that ST can facilitate learning proper movement patterns. Furthermore, using a multiple-baseline design, Landin and Herbert (1999) found that instructional ST improved tennis volleying technique, and that the improvements in technique were greater than the improvements in performance outcome (accuracy of volley).

Although subjective evaluations of technique provide insight into how ST
functions, they can be influenced by the thoughts of the evaluator. Objective measurements of movement have been conducted to determine how ST influences movement patterns. Edwards, Tod, and McGuigan (2008) assessed the effects of ST on center of mass displacement and movement kinematics during a vertical jump for experienced Rugby athletes. Both motivational and instructional ST did impact the movement kinematics of the hip joint; participants in the motivational and instructional ST conditions had greater hip angular displacement and angular velocity compared to a control group. Additionally, only the motivational ST group had greater center of mass displacement than the control group. Given the similar changes in movement kinematics and differences in center of mass displacement, the authors suggested that those in the instructional ST might have focused these technique variables that were involved in the ST at the expense of others that help performance on the task. Furthermore, Tod, Thatcher, McGuigan, and Thatcher (2009) conducted a similar study using the vertical jump with healthy (non-elite athletes) individuals and assessed other movement kinematics. The results indicated a higher center of mass displacement, impulse, and angular rotation around the knee for the motivational and instructional ST groups compared to a control group. Taken together, the results indicate that ST can influence both subjectively evaluated technique and objectively measured movement kinematics.

2.3.3 Affective mechanisms. Hardy, Oliver and colleagues (2009) used the term “affective mechanisms” to include changes in affect, mood, and anxiety that may mediate the ST-performance relationship. In one of the first studies to empirically investigate athletes’ ST and affect, Hardy, Hall and colleagues, (2001) demonstrated that the valence of ST (negative-positive) is associated with the valence of affect (unpleasant
affect-pleasant affect) and that the intensity of affect (sleepiness-aroused) is positively correlated with the motivational qualities of ST (demotivating-motivating). Experimental evidence also suggests a relationship between ST and athletes’ affect. Hatzigeorgiadis, Zourbanos, Mpoumpaki, and Theodorakis, (2009) found that motivational ST can help significantly decrease cognitive anxiety from pre-test to post test.

Hatzigeorgiadis and Biddle (2008) also provided evidence of a ST-affect relationship in their investigation of cross-country runner’s pre-competition anxiety and their ST. In the first part of their study, runners who viewed their anxiety as facilitative to their performance did not differ in pre-competition anxiety intensity from those who perceived it as debilitative. However, the athletes in the facilitative group engaged in significantly less negative ST during their performance than athletes who reported that their anxiety was debilitative. In the second part of their study, the researchers found that goal discrepancies, or the difference between the race time the runner wanted to achieve and the actual time they achieved, was a better predictor of negative ST than perceptions of pre-competition anxiety. Athletes who performed much worse than they wanted to engaged in more negative ST. However, athletes’ perceptions of pre-competition anxiety as either facilitative or debilitative accounted for additional variance, suggesting that this perception is associated with athletes’ use of negative ST in competition.

Given that ST can be more or less beneficial to performance depending on the task (e.g., Theodorakis et al., 2000) and the cue word used (e.g., Hatzigeorgiadis et al., 2004), Hatzigeorgiadis and colleagues, (2007) suggested that the function of ST might depend on the content of ST and the nature of the task. To test this hypothesis, they assigned participants to use either an instructional/attentional cue (i.e., ball-target) or a
motivational/anxiety control cue (i.e., calmly) to complete a five-day ST intervention. The participants were asked to report the function of their ST and measures of the functions (e.g., confidence) were also collected. According to participants’ reports, the anxiety control cue was more effective for anxiety control than the attentional cue and both cue words were similar for increasing effort, confidence, automaticity, and attention. Similar results were revealed in the direct measurements; somatic and cognitive anxiety were lower for participants using the anxiety control cue and both groups had similar levels of confidence, cognitive interference, automaticity, and effort. Overall the results provide partial support that different types of ST serve different functions.

2.3.4 Motivational mechanisms. Hardy, Oliver and colleagues (2009) used the term motivational mechanisms to describe the effect ST has on self-efficacy and goal persistence. Hardy (2006) used Bandura’s (1997) self-efficacy theory to explain how ST may influence self-efficacy. According to self-efficacy theory, verbal persuasion can be a source of self-efficacy. Hardy explained that ST could be a form of verbal persuasion from the self, thus promoting self-efficacy. Given the established relationship between self-efficacy and performance (Moritz, Feltz, Fahrbach, & Mack, 2000), self-efficacy is a theoretically plausible mediator between ST and performance.

Experimental research has provided support for the motivational mechanisms of athletes’ ST. Hatzigeorgiadis, Zourbanos, Golsios, and Theodorakis (2008) examined the effect of a motivational ST cue on young tennis players’ self-efficacy and performance of the forehand drive. The researchers performed post-manipulation checks to ensure that the experimental group used a motivational ST cue and that the control group did not use motivational or instructional ST. The results indicated that motivational ST could
improve both performance and self-efficacy. Additionally, performance improvements were related to increases in self-efficacy, providing evidence that ST may enhance performance through increases in self-efficacy. In a similar study with tennis players and the forehand drive, Hatzigeorgiadis and colleagues (2009) determined that motivational ST enhanced both performance and self-confidence, and that changes in performance were related to changes in self-confidence.

In a recent study, Zourbanos and colleagues (2013) also examined the effect of motivational ST on self-efficacy and performance. However, in their study the participants were novice undergraduate students who completed a precision-based dart-throwing task. A motivational ST cue was effective for increasing self-efficacy but ineffective for improving task performance. The researchers suggested that an instructional ST cue might have been more appropriate for performance enhancement, according to the matching hypothesis proposed by Zourbanos and colleagues (2013).

2.4 Negative Self-talk and Performance Improvement

Researchers suggest that negative ST can benefit performance through motivational mechanisms. Van Raalte and colleagues (1994) suggested that negative ST is related to motivation through self-confidence. That is, negative ST can motivate athletes because they know they can do better. For example, an athlete may say, “that was a terrible mistake” and be motivated because they have more confidence in their abilities. Goodhart (1986) suggested that individuals are motivated by negative ST because they think of a negative outcome and try harder to avoid it from happening. For example, if an individual thought, “last time I failed”, they may increase their effort to avoid another
failure. Furthermore, Hamilton and colleagues (2007) suggested that athletes could interpret their negative ST as a challenge and be motivated to complete the challenge. Although negative ST can serve a motivational function for some athletes, the relationship between negative ST and performance is unclear. Van Raalte and colleagues (2000) found no relationship between losing and negative ST and explained that everyone can interpret the same type of ST differently. When experimentally studying negative ST and performance, researchers assign negative ST cue words and examine subsequent performance. Perhaps some athletes naturally interpret their negative ST in a motivational fashion and others don’t. If this is the case, it may be possible to teach individuals how to interpret their negative ST in a motivational manner.

2.5 Conclusion

Currently the effects of negative ST on performance are unclear. Negative ST has been associated with negative (Harvey et al., 2002; Van Raalte et al., 1994), neutral (Van Raalte et al., 2000), and even positive (Hamilton et al., 2007) performance. The performance benefits have been explained through motivational mechanisms, but it is unlikely that negative ST is naturally motivational for everyone. In fact, in a study by Hardy, Hall and colleagues (2001), some participants, but not all, reported their negative ST to be motivational. Even within the same study, performance effects have varied (Hamilton et al.). It is plausible that the interpretive nature of ST accounts for the varied performance effects. Previous studies have assigned negative cue words to participants to use and they are free to interpret them accordingly. However, the present study will determine if individuals can be given negative ST cues and be taught to interpret them in
a motivational manner. The purpose of the present study is to examine the motivational function of negative ST on an endurance task.
CHAPTER 3

METHODOLOGY

3.1 Participants

A total of 96 participants were recruited for the study from a university campus. Each participant provided informed consent, and were deemed safe to participate in physical activity according to the Physical Activity Readiness Questionnaire (PAR-Q). Three of the 96 participants withdrew before completion due to injury unrelated to the study. All of the reported data is presented on the 93 participants who completed the study in its entirety. The participants’ age ranged from 18 to 29 (M= 20.4, SD= 2.4). There were 53 males and 40 females in the study. The males had a mean height of 180.6cm (SD= 7.2) and a mean weight of 82.0kg (SD= 12.5); the females had a mean height of 167.4cm (SD= 5.7) and mean weight of 64.4kg (SD= 10.9).

3.2 Task and Dependent Variables

The participants completed a 20-minute cycling task in order to measure their endurance performance. This task was chosen over a time trial in order to prevent the possibility of the participants working harder for the purpose of finishing the task sooner. As well, the cycling task relies less on a specific skill set to perform than other endurance tasks. If a task such as swimming was used, the performance would be more of a reflection of technique and effort. The participants were instructed to hold the handlebars and their feet were strapped in to limit differences in technique. This allowed the task to be a simple effort based task.

The dependent variables that were measured to compare overall task performance were average % predicted VO$_2$max and distance travelled. The average % predicted
VO₂max was used as a measure of effort relative to the individual’s maximal aerobic capabilities; the distance travelled was an absolute measure of performance. Additionally, the distance travelled in 5-minute time blocks was recorded in order to examine how the ST interventions affected performance at different time segments of the task, as initial evidence suggest ST effects may vary within an endurance task (Barwood et al., 2015).

3.3 Self-Talk Conditions

The participants were stratified into one of four ST conditions according to their predicted VO₂max: challenging (13 males, 10 females), negative (13 males, 10 females), neutral (13 males, 10 females), and positive (14 males, 10 females). Individuals could only use cue words that matched their group according to both content and perceived function. For example, some individuals in the negative group proposed using “I’m going slow,” which is negative in content. However, some of the participants mentioned that this would actually encourage them to go faster, making it no longer negative based on its perceived function. Furthermore, the neutral group used words that served no motivational qualities, but were still relevant to the cycling task in order to limit any disassociation effects.

*Positive ST*: ST that is encouraging, motivational, and suggests an ability to succeed at the task (e.g., Keep it up).

*Negative ST*: ST that is discouraging, and suggests an inability to succeed at the task (e.g., My legs are tired).

*Neutral ST*: ST that is relevant to the task, but not related to performance on the task. It does not serve any positive or negative motivational qualities (e.g., I am on a bike).
Challenging ST: ST that begins with a negative statement, followed by a challenging statement which serves to embrace the negative statement in a motivational manner (e.g., My legs are tired, but I know I can do this).

3.4 Measures and Procedures

3.4.1 Phase 1. At the beginning of phase one, all of the participants provided informed consent and were deemed safe to engage in physical activity according to the PAR-Q. Following the completion of these forms, the participants’ height and weight were collected and the predictive VO$_2$max test was conducted.

3.4.1.2 Predictive VO$_2$max test. All participants completed the predictive VO$_2$max test on a Velotron cycling ergometer. The ASTRAND incremental cycling protocol was followed, with a modification used for male testing. For females, the participants began cycling at a workload of 50 watts for three minutes, and the workload increased by 25 watts every two minutes thereafter. For males, the protocol started at 100 watts for three minutes and increased by 35 watts every two minutes thereafter. All of the participants were told that their goal was to last as long as they can. Towards the end of each trial, the participants were provided verbal encouragement to help ensure that a true max result was obtained.

To calculate predicted VO$_2$max, the ACSM predictive equation for leg cycling was used: \[ \text{VO}_2 (\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}) = 1.8(\text{Work Rate in kg.m.min}^{-1}) / (\text{Body Mass in Kg}) + 3.5 \text{ mL.kg}^{-1}.\text{min}^{-1} + 3.5 \text{ mL.kg}^{-1}.\text{min}^{-1} \]. The work rate was taken from the maximum watts that each participant could maintain for at least one minute during the ASTRAND protocol. VO$_2$max is a measurement of aerobic capabilities. Therefore, predicted VO$_2$max was used as a sorting variable to ensure groups were even in endurance abilities.
3.4.2 Phase 2. In phase two, the participants’ collaborated with the primary researcher to develop their ST plans according to their assigned group. The participants used their ST plans while completing a 20-minute cycling task. Phase two took place within three weeks of phase one for all participants, and was within two weeks for the majority.

3.4.2.1 Self-talk plan. The participants were provided a description of the type of ST for their group. In order to make it easier to maintain groups, the participants were not informed that other participants were assigned different types of ST. For example, if one participant was told to do their best and use negative ST, but they knew they were being compared to others using positive ST, it may have been more difficult for them to use negative ST.

With the assistance of the researcher, the participants created a list of ST statements that matched the descriptions they were provided. The participants were told that they were creating their ST statements instead of receiving a list because a) ST is interpretative, so the same words can have different meanings to different people, and b) by choosing the words, the participants can pick words that they are comfortable using. The participants were also instructed to consider the various time points because cue words that are relevant near the beginning may not be relevant towards the end and vice-versa (e.g., Start Strong; Finish Strong).

All groups initially created eight ST statements, except for the challenging group which created five. The challenging group created less because the challenging ST involved a negative and a challenging component. Four of the ST statements were chosen to be used during the cycling task, with one being used every five minutes. Creating more
ST statements than required for the task helped ensure that the participants understood
the type of ST they were using. It also allowed the researcher and participant to choose
the statements that best met the criteria for that type of ST. Once the four statements were
chosen, the participants wrote them out ten times, or five times for each for the
challenging group, to gain familiarity with the words.

3.4.2.2 Cycling task. The participants completed the 20-minute cycling task.
Their objective was to get as far as possible in the time provided. A simulated course was
designed using Velotron software. The course was straight with a 1.5% incline, to limit
any distance gained by cruising. The participants were unaware of the course design.

The participants’ ST statements were presented on a screen in front of them to
prompt their ST use. Every five minutes the primary researcher would change the ST
statements and inform the participants how much time was remaining; the participants
knew when there were five, ten and fifteen minutes into the cycling task. The participants
were also informed when they had two minutes remaining. No additional information
pertaining to their performance on the cycling task was provided (e.g., distance).

The participants were unable to change the gearing during the task, and the gear
was set so any participant could complete the 20 minutes, but they were also able to push
themselves as hard as they wanted. Males and females had a different gearing that was
proportional to their results on the ASTRAND cycling task in the first trial. For the males
and females, the gearing was set to 28/11 and 28/14 respectively. Gearing programed
according to the factory settings of the Velotron software.

3.4.2.3 Manipulation check. To ensure group conditions were met the
participants were asked to report their ST use every five minutes. The participants were
shown a visual scale from one to ten and asked to report how often they used the words on the screen, “one” being not used at all, and “ten” being used consistently. A copy of the scale is provided in appendix 2. If a participant reported using the cue words less than a 6/10, they were instructed to focus on the words as much as they could.

Upon completion of the cycling task the participants were asked to recall their cue words from memory. Additionally, the participants were asked to rate on the same 10-point scale how often they used other types of ST in a consistent manner. If the participants used words other than those on the screen, they were asked what other words they used. If the other ST was the same type that was assigned to them, it was not considered to be another form of ST.

In order to satisfy group requirements, the participants had to have: a) an average ST check of at least seven out of ten, b) no single check less than five, c) at least three of the words recalled on the memory check, and d) reported other ST use no more than a three out of ten. The participants could violate one of these criteria given that all other measures suggested adequate ST use.

### 3.5 Data Analysis

The data was analyzed using SPSS Statistical software version 22. For all of the statistical analyses, an alpha level of $p<0.05$ was used. For the assumptions, normality was assessed using the Shapiro-Wilk test, homogeneity of variance was assessed using Levene’s Test, homogeneity of intercorrelations was assessed using the Box’s M statistic, and sphericity was assessed using Mauchly’s test of sphericity. When the assumption for normality was violated, the non-parametric alternative was used. When the assumption of
sphericity was violated, Greenhouse-Geisser corrections were used. Bonferroni adjustments were used whenever multiple comparisons were made.

In order to ensure the effectiveness of the group stratification, two two-way ANOVAs were conducted. The first two-way ANOVA ensured that groups were similar in predicted VO$_2$max when adding sex as a factor. The second two-way ANOVA ensured that weight by sex was similar between groups because weight was used in the calculation of predicted VO$_2$max. Furthermore, means, min and max values, and standard deviations were calculated to analyze the manipulation check data.

In order to analyze overall task performance, a two-way between-groups ANOVA and a Kruskal-Wallis test were used. The two-way ANOVA compared the percentage of predicted VO$_2$max that participants worked at while adding sex as a factor. The Kruskal-Wallis test was used for overall cycling distance because the assumption for normality was violated. The Kruskal-Wallis compared overall distance covered between groups with sex as an independent variable. Additionally, a mixed between-within subject ANOVA was used to analyze the task performance across the time blocks. For this analysis, the within factor was time, and the between factors were sex and group.

Finally, in order to examine the trend over time, 95% confidence intervals were calculated that compared the percent difference in distance from the neutral/control group to the other groups. Percentage difference was calculated as (comparison group – neutral group)/neutral group. The calculations were conducted for each time block and the overall cycling distance. Each comparison group participant (i.e. challenging, positive, negative) was compared to the neutral group participant who had the same predicted VO$_2$max ranking for their sex. For example, the percentage difference of the male who
had the third highest predicted VO₂max was calculated using the data from the male who had the third highest predicted VO₂max in the neutral group. This ranking was performed in order to compare the participants who were the most similar in performance.
CHAPTER 4

RESULTS

4.1 Group Stratification

Male and female participants were stratified into groups separately according to their predicted VO\(_2\)max. Means and standard deviations of weight and predicted VO\(_2\)max by group are presented in table 1. Weight is included because it was used in the VO\(_2\)max predictive equation.

Table 1.

*Stratification of Predicted VO\(_2\)max by Group for Males and Females*

<table>
<thead>
<tr>
<th>Group</th>
<th>Predicted VO(_2)Max</th>
<th>Weight (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>SD</td>
</tr>
<tr>
<td>Challenging</td>
<td>42.16</td>
<td>5.1</td>
</tr>
<tr>
<td>Negative</td>
<td>43.06</td>
<td>5.7</td>
</tr>
<tr>
<td>Neutral</td>
<td>43.24</td>
<td>6.2</td>
</tr>
<tr>
<td>Positive</td>
<td>41.48</td>
<td>5.7</td>
</tr>
</tbody>
</table>

To ensure that all the stratification process worked, meaning that the groups were similar in predicted VO\(_2\)max and weight, two two-way ANOVAs were conducted. Relevant assumptions for normality and equality of variances were tested and were not violated. The first ANOVA revealed no significant main effect between groups in weight, \(F(3, 85) = 0.584, p=0.627\), and no significant interaction between sex and group on weight, \(F(3, 85) = 0.688, p=0.562\). The second ANOVA revealed no significant main effect between groups in predicted VO\(_2\)max, \(F(3, 85) = 0.222, p=0.881\), and no significant interaction effect between sex and group on predicted VO\(_2\)max, \(F(3, 85) = 0.103, p=0.958\). Significant main effects for sex were expected and found in both
ANOVAs. These were controlled for in the stratification process by placing an equal amount of males and females in each group.

4.2 Manipulation Check

The results from the manipulation check demonstrated that group conditions were met according to the criteria set out in the procedure with three exceptions. Two of the participants had an average score slightly below the 7 minimum (i.e., 6.25 and 6.5). However, closer examination showed that these participants recalled all four ST statements by memory, and reported using other types of ST very little (i.e., 1/10 and 2/10). The third exception was a participant who reported a 3 during the manipulation check. However, this participant still met the average requirement of 7 with an average of 7.75. This participant also recalled all four ST statements, and reported a 1/10 on other ST use.

Means and standard deviations for each group are presented in table 2. For the challenging groups’ memory recall, the participants were given a half point if they remembered either the negative or challenging component of a ST statement.
Table 2.

*Manipulation Check Data by Group*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Challenging</th>
<th></th>
<th>Negative</th>
<th></th>
<th>Neutral</th>
<th></th>
<th>Positive</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Check 1</td>
<td>7.89</td>
<td>1.29</td>
<td>8.15</td>
<td>0.87</td>
<td>8.58</td>
<td>1.00</td>
<td>8.35</td>
<td>1.53</td>
</tr>
<tr>
<td>Check 2</td>
<td>8.34</td>
<td>1.11</td>
<td>8.08</td>
<td>1.23</td>
<td>8.78</td>
<td>1.12</td>
<td>8.41</td>
<td>1.34</td>
</tr>
<tr>
<td>Check 3</td>
<td>8.91</td>
<td>0.99</td>
<td>8.32</td>
<td>1.27</td>
<td>8.39</td>
<td>1.26</td>
<td>8.83</td>
<td>0.86</td>
</tr>
<tr>
<td>Check 4</td>
<td>9.26</td>
<td>1.05</td>
<td>8.65</td>
<td>1.11</td>
<td>8.91</td>
<td>1.12</td>
<td>9.10</td>
<td>1.21</td>
</tr>
<tr>
<td>Other ST Check</td>
<td>1.52</td>
<td>0.66</td>
<td>1.71</td>
<td>0.80</td>
<td>1.58</td>
<td>0.88</td>
<td>1.54</td>
<td>0.83</td>
</tr>
<tr>
<td>Memory Check</td>
<td>3.65</td>
<td>0.41</td>
<td>3.89</td>
<td>0.28</td>
<td>3.95</td>
<td>0.20</td>
<td>3.91</td>
<td>0.29</td>
</tr>
</tbody>
</table>

*Note.* Check 1 = check at 5 min; Check 2 = check at 10 min; Check 3 = check at 15 min; Check 4 = check at 5 min. Memory Check is out of 4, all other checks are out of 10. Higher check values correspond with higher ST use.

### 4.3 Main Analyses

#### 4.3.1 Overall cycling task performance.

A two-way between-groups ANOVA was used to examine the difference between group and sex on the percentage of predicted VO$_2$max that the participants worked at during the cycling task. The assumptions for normality and equality of variances were not violated. There was no significant main effect for group, $F(3, 85) = 1.78, p= 0.156$, and there was no significant interaction between group and sex, $F(3, 85) = 0.325, p= 0.807$. There was a significant sex effect, but this was not within the scope of the study.

The data for total cycling distance between groups violated the assumption for normality, so the non-parametric Kruskal-Wallis test was used. The Kruskal-Wallis Test revealed no significant difference in total cycling distance across the four ST groups, $x^2(3, n=93) = 2.53, p = 0.468$. Results of both overall comparisons are presented in table 3.
Table 3.

*%Predicted VO$_{2\text{max}}$ and Overall Distance by Group*

<table>
<thead>
<tr>
<th>Group</th>
<th>%Predicted VO$_{2\text{max}}$</th>
<th>Overall Distance (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Challenging</td>
<td>73.48</td>
<td>5.82</td>
</tr>
<tr>
<td>Negative</td>
<td>69.87</td>
<td>8.15</td>
</tr>
<tr>
<td>Neutral</td>
<td>69.61</td>
<td>7.98</td>
</tr>
<tr>
<td>Positive</td>
<td>72.99</td>
<td>6.96</td>
</tr>
</tbody>
</table>

The 95% confidence intervals were calculated for the percent difference in overall distance between the neutral/control group and the comparison groups. The confidence intervals are presented in figure 1.

**Figure 1.** 95% Confidence Intervals for Percent Difference in Overall Distance

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Figure 1. Percent difference is the average percent difference from the neutral/control group to the comparison groups. Percent difference was calculated as ((comparison group – neutral group)/neutral group)*100%. The percent difference was calculated for each comparison group member and the neutral group with the same predicted VO$_{2\text{max}}$ ranking.
4.3.2 Cycling performance by time. A mixed between-within subjects ANOVA was conducted to assess group and sex differences on the distance covered every five-minute time block during the cycling task. Time block one refers to the distance covered from 0-5 minutes; Time block two refers to the distance covered from 5-10 minutes; Time block three refers to the distance covered from 10-15 minutes; Time block four refers to the distance covered from 15-20 minutes. The time blocks were used as the within factor, and group and sex were used as between factors. The assumptions for normality, equality of variances, and homogeneity of intercorrelations were met. The assumption for sphericity was violated; all within-subjects effects were analyzed using the Greenhouse-Geisser correction.

The between subjects effects revealed no significant difference between groups, F(3, 85) = 1.13, p = 0.341, and no significant interaction between group and sex, F(3, 85) = 0.340, p = 0.796. A sex difference was determined, F(1, 85) = 89.2, p <0.001. However, the sex effect was not relevant to the purpose of the study so further analyses on this finding was not performed.

The results revealed a significant main effect for time, F(1.5, 85) = 12.907, p<0.001. Pairwise comparisons using the Bonferroni adjustment revealed that the mean distance covered in the in time block four (M=1.88, SD= 0.29) was significantly greater than in time block one (p=0.022; M=1.81, SD=0.33), time block two (p=0.15; M=1.80, SD=0.30), and time block three (p=0.01; M=1.81, SD=0.28).

A significant interaction effect was found for time and sex, F(1.54, 85) =9.117, p =0.001, and for time and group, F(4.6, 85) = 2.549, p=0.035. No significant interaction between time, group, and sex was found F(4.62, 85) = 0.194, p = 0.957. Pairwise
comparisons were conducted using Bonferroni adjustments to examine the significant interaction effects. Figure 2 represent the distance covered each time block by sex.

**Figure 2.** Distance Covered Each Time Block by Sex

*Figure 2.* Time block one refers to the distance covered from 0-5 minutes; Time block two refers to the distance covered from 5-10 minutes; Time block three refers to the distance covered from 10-15 minutes; Time block four refers to the distance covered from 15-20 minutes. Error bars represent standard deviations.

For the interaction between time block and sex, a significant difference (p=0.028) was found between time block one and two for the males, but not the females. Additionally, females were significantly different (p = 0.001) between time block one and four, and significantly different (p = 0.015) between time block two and three, but males were not. Time block three and four were significantly different for both males (p=0.001) and females (p=0.001).
Table 4.

*Distance Covered in Kilometers Each Time Block by Group*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Challenging&lt;sup&gt;a,b,c&lt;/sup&gt;</th>
<th>Negative</th>
<th>Neutral&lt;sup&gt;a,b&lt;/sup&gt;</th>
<th>Positive&lt;sup&gt;a,b,c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Time Block 1</td>
<td>1.84</td>
<td>.32</td>
<td>1.80</td>
<td>.33</td>
</tr>
<tr>
<td>Time Block 2</td>
<td>1.83</td>
<td>.29</td>
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</tr>
<tr>
<td>Time Block 3</td>
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<td>.26</td>
<td>1.74</td>
<td>.29</td>
</tr>
<tr>
<td>Time Block 4</td>
<td>1.97*</td>
<td>.27</td>
<td>1.76*</td>
<td>.31</td>
</tr>
</tbody>
</table>

*Note.* *Significant difference between groups, p<.05. Letters represent significant differences within groups, p<.05: <sup>a</sup> Significant difference between time block 2 and 4, <sup>b</sup> Significant difference between time block 3 and 4, <sup>c</sup> Significant difference between time block 1 and 4.

Table 4 presents means and standard deviations for the interaction between time and group. Pairwise comparisons revealed that time block four was significantly (p=0.023) different between the challenging ST group and the negative ST group. Additionally, the participants in all groups except the negative group covered significantly more distance in time block four than time block two (Challenging: p=0.001; Neutral: p=0.042; Positive: p=0.009) and three (Challenging: p=0.001; Neutral: p=0.001; Positive: p=0.008). Finally, the participants in the challenging ST and the positive ST groups covered more distance in time block four than they did in time block one (Challenging: p=0.012; Positive: p=0.029). Figure 3 displays the means of each group by time block.
**Figure 3.** Distance Covered in Each Time Block by Group

Figure 3. Time block one refers to the distance covered from 0-5 minutes; Time block two refers to the distance covered from 5-10 minutes; Time block three refers to the distance covered from 10-15 minutes; Time block four refers to the distance covered from 15-20 minutes. Error bars represent standard deviations.

An inspection of Figure 3 reveals a trend between groups across the time points. In the last five minutes of the 20-minute cycling task, the challenging group covered significantly more distance than the negative group. Although there were no significant differences between groups at the other time blocks, there was a trend for the order of groups across the time points. At every time point, the challenging group covered the most distance and the negative group covered the least. Additionally, in three out of four time points the positive group and neutral group covered the second and third most distance respectively.

In order to further examine the data, 95% confidence intervals were calculated for the average percent difference of similarly ranked individuals in each group to the neutral/control group. The data is presented in figure 4 for the percent difference for each time block.
Figure 4. Percent difference is the average percent difference from the neutral/control group to the comparison groups. Percent Difference was calculated as \(((\text{comparison group} - \text{neutral group})/\text{neutral group})\times100\%\). The percent difference was calculated for each comparison group member and the neutral group with the same predicted VO\textsubscript{2}max ranking.

When examining figure 4, there are a few notable trends. First, there is a trend for the challenging group where the confidence intervals increase over time. A similar trend is present for the positive group; however, there is no increase from the third to the fourth time block. Additionally, the negative group has an opposite trend, where the confidence intervals are decreasing over time.

When comparing these confidence intervals between groups, a lot of overlap exists between the challenging and positive groups. When comparing the confidence intervals of both the challenging and positive group to the negative group, the overlap tends to decrease across time blocks. As time progressed, the challenging and positive groups tended to increase their performance compared to the neutral group, and the
negative group decreased their performance compared to the neutral group. Finally, in the last time block, there was very little overlap between the challenging and negative group, which is to be expected according to the significant finding.
CHAPTER 5
DISCUSSION

The purpose of this study was to investigate the motivational function of negative ST on an endurance task. According to the results, the first and second null hypotheses are accepted; there were no significant differences between groups in their predicted %Vo2max, or distance covered. Additionally, the third null hypothesis is rejected; a significant interaction effect between time and group on distance was present.

Although group differences were absent on overall task performance, the interaction effect between group and time provide insight into the ST-performance relationship. In the final time block, the participants whose negative ST was accompanied with a challenging statement significantly outperformed those who only used negative ST. This indicates that time within an endurance task is a moderator of the ST-performance relationship. Additionally, the study shines light on the motivational function of negative ST and clarifies the equivocal results in the existing literature.

5.1 Overall Cycling Performance

Overall, the groups performed similarly on the task. This finding is inconsistent with the majority of previous research, which has found ST interventions to improve endurance task performance (McCormick, Meijen, & Marcora, 2015). The performance improvements have been found in a variety of endurance tasks, including time to exhaustion tasks (Blanchfield, Hardy, De Morree, Staiano, & Marcora, 2014), time trials (Barwood et al., 2015; Hatzigeorgiadis et al., 2014.), and endurance tasks with a set time (Hamilton et al., 2007). However, not all research has shown ST to significantly improve endurance performance. Weinberg, Smith, Jackson, and Gould (1984) found that groups
who participated in an association, dissociation, positive ST, or no-intervention performed similarly on a 30-minute run.

The null finding in the present study may be attributed to the intervention length, as longer ST interventions tend to have stronger performance effects than shorter interventions (Hatzigeorgiadis et al., 2011). After a two-week motivational ST intervention, Blanchfield and colleagues (2014) found performance improvements on a time to exhaustion cycling task. Additionally, Hatzigeorgiadis and colleagues (2014) implemented a ten-week ST intervention that improved competitive swimming performance. However, in the present study a longer intervention could not be included due to the large number of participants involved and time constraints.

Although interventions with training have stronger effects than interventions without training, research suggests that short interventions can still have a meaningful impact on performance (Hatzigeorgiadis et al., 2011) and significant performance effects have been found following short ST interventions (Barwood et al., 2015). Although the present study did not demonstrate statistically significant differences between groups on the task in its entirety, the challenging group’s 95% confidence intervals for percent difference did not contain negative values, which suggests its usefulness as a strategy for enhancing endurance performance. Alternatively, the positive and the negative groups’ 95% confidence intervals contained both positive and negative values.

5.2 Cycling Performance Across Time Blocks

When comparing the groups by time blocks, there was a significant interaction effect, where the challenging group outperformed the negative group in the final time block. Additionally, there was a trend in the 95% confidence intervals, where the
challenging group and the positive group tended to outperform the neutral group to a
greater extent as time progressed. Alternatively, as time progressed on the task, the
negative group’s performance tended to worsen when compared to the neutral group. In
the only other study to examine the effect of ST within an endurance task, Barwood and
colleagues (2015) compared a neutral ST group and a motivational ST group on a 10km
time trial. When comparing the two groups at each kilometer of the time trial, the
motivational group significantly outperformed the neutral group from the seventh to tenth
kilometer. Additionally, Barwood and colleagues found that the difference between
groups increased as the task progressed, with the largest difference between groups
occurring during the final kilometer of the time trial. Taken together, the results of
Barwood and colleagues and of the present study suggest that time within an endurance
task is a moderator of the ST-performance relationship, where ST can have a stronger
effect as the endurance task progresses from start to finish. As an individual completes an
endurance task the demands on the individual increase. This increase in task demands
may make the individual’s ST more important in the later stages of the endurance task
compared to the earlier stages.

The suggestion of a temporal moderator in the ST-performance relationship for
endurance tasks can be explained according to Van Raalte, Vincent, and Brewer’s (2016)
recently proposed model for ST research in sport. The model distinguishes between
System 1 and System 2 ST. System 1 refers to ST that is emotionally driven, automatic,
and requires minimal cognitive effort. An example of System 1 ST would be an athlete
saying “darn it” or “opps” after making a mistake. Alternatively, System 2 refers to ST
that requires more cognitive effort and is said in a more deliberate manner. An example
of System 2 ST would be an athlete saying “alright, I will reset and get the next one” after making a mistake. System 2 ST can be either proactive or reactive depending if it was planned in advance or not. When the ST cue words are planned in advance, as is the case in ST interventions, it is considered to be System 2 proactive ST.

In their model, Van Raalte and colleagues (2016) propose a ST dissonance hypothesis. According to this hypothesis, ST consonance exists when an individual’s System 1 and proactive System 2 ST are in accord, and this consonance makes it easier for an individual to process their System 2 ST. Alternatively, ST dissonance exists when System 1 and proactive System 2 ST are not in accord, and this dissonance makes it more difficult for an individual to process their System 2 ST. For example, if an individual is automatically thinking “I can’t do this” (System 1 ST), and is using assigned ST such as “I can do this” (proactive System 2 ST), they would have difficulty processing the assigned ST because it is dissonant or inconsistent with their automatic thoughts. Alternatively, if the individual is automatically thinking “I can do this” and is assigned a cue word “keep it up”, they would find it easier to process their assigned cue words because the assigned cue words are consonant with their automatic thoughts.

The interaction effect in the present study can be explained according to the ST dissonance hypothesis. Throughout the task, the participants’ System 2 ST type was controlled for and did not change. However, the participants’ System 1 ST likely became increasingly negative as the task progressed and the participants became more fatigued. In fact, Hardy, Roberts, and Hardy (2009) found that individuals report automatic negative ST occurring the most during the end of a workout, and that feelings of fatigue are one of the most reported antecedents of automatic negative ST. Therefore, as the
participants’ System 1 ST became more negative, the challenging and negative groups’ ST became increasingly consonant and the neutral and positive groups’ ST became increasingly dissonant. The feelings of fatigue not only peaked in the final time block because of task duration, but also because the participants pushed themselves the hardest in this time block, as indicated by covering the most distance. With ST consonance during the final time block, the challenging and negative groups were able to maintain focus on their assigned cue words. Although both of these groups used negative cue words, the challenging group used an additional challenging statement. The challenging statement allowed the challenging group to use ST that was consonant and positive, while the negative group used ST that was consonant and negative. Having consonant and positive ST improved the challenging group’s performance, by helping them focus on the positive aspects of performance, like doing their best and finishing strong. Alternatively, having consonant and negative ST impaired the negative group’s performance, by helping them to focus on the negative elements of performance, like feelings of fatigue and wanting to stop.

**Figure 5.** Self-talk Dissonance in the Final Time Block
Furthermore, Blanchfield and colleagues (2014) implemented a motivational ST intervention that involved using positive ST statements to counter automatic negative ST. The participants in their study who received the intervention significantly improved their performance on a time to exhaustion task, and the participants who did not receive an intervention had no changes in performance. Additionally, the rating of perceived exertion (RPE) at 50% isotime was significantly lower for the intervention group while using their ST, and no such changes were present for the no-intervention group. The researchers concluded that lowering RPE is a mechanism through which ST improves endurance performance. The findings from Blanchfield and colleagues strengthen the argument for the dissonance/consonance explanation provided for the present findings because they suggest that ST increases endurance performance by lowering the perception of fatigue. In the present study, it is likely that the perceptions of fatigue were lowered for the challenging group because they achieved ST consonance and were focused on their positive elements of their ST statements, rather than on their feelings of fatigue. Alternatively, it is likely the perception of fatigue was increased for the negative group because they achieved ST consonance, but with ST that focused on the feelings of fatigue.

When interpreting the significant difference between the challenging group and the negative group at the final time block there are a few important considerations. First, although it was not statistically significant, the average distance covered was higher for the challenging group than the negative group at every time point. This ensures that group differences are not the result of pacing. For example, if the challenging group covered less distance at the beginning of the task and more at the end, it is possible that
the end difference is the result of saving energy at the beginning of the task. Finally, both groups used similar negative ST statements, the only difference being that the challenging group had an additional challenging statement.

The insignificant differences involving the positive and neutral ST groups are the result of their ST dissonance. These two groups experienced ST dissonance during the task, particularly during the final stages where they experienced high levels of fatigue. While experiencing ST dissonance, the individuals were unable to process their assigned cue words as effectively as the challenging and negative groups. Therefore, the positive and neutral groups’ performance was poorer than the challenging group who used consonant-positive cue words, and greater than the negative group that used consonant-negative cue words.

5.4 Sex Differences

There was a significant difference in the pacing employed between males and females in the study. The females tended to increase their pace as time progressed, whereas the males started and ended strong, and their pace decreased in the middle. When interpreting these findings, it is important to consider that gearing was higher for the males than the females. The difference in gearing was to accommodate for sex differences in exercise performance. However, upon completion of the task all participants (males and females) reported that the gearing selected was low enough so there was no issue completing 20 minutes, but high enough so that the participants could push themselves as hard as they wished. In order to control for sex differences in performance, males and females were sorted into groups separately.
5.5 Defining Negative Self-Talk

In addition to clarifying the performance effects of ST, this study highlights the importance of appropriately defining positive and negative ST. In the existing ST literature, ST valance is defined by both content and performance effect, and the definition that is used is not always clear (Theodorakis, Hatzigeorgiadis, & Zourbanos, 2012). This is problematic when you consider ST that includes negative content may be positive in performance effect, which occurred with the challenging group. The inconsistencies in defining ST valence may account for the mixed findings in the ST literature, particularly with negative ST (Tod et al., 2011). For clarification in future research, Theodorakis, Hatzigeorgiadis, and Zourbanos proposed defining ST valence according to its content, and using the terms facilitative and debilitative to describe the performance effects of ST. In light of the present findings, where ST containing negative content had a positive effect on performance, it is recommended that the nomenclature proposed by Theodorakis, Hatzigeorgiadis, and Zourbanos be used.

In the present study, positive and negative ST were defined according to both content and perceived performance effect. The importance of distinguishing between ST content and function was evident during the interventions, particularly with the negative ST group. Often the participants in the negative group proposed using cue words that were negative in content, but were also motivational. A common example of this would be using the cue word “I’m going slow”. Although this statement is negative in content, some of the participants reported that this would be motivational for them. In these situations, the participant had to choose an alternate cue word that matched their group’s assigned ST type according to both content and perceived function. By controlling for
content and perceived function, the present study provided a more precise description of the ST being studied, which may have resulted in the poorer performance of the negative group in the final time block.

The motivational characteristics of negative ST are present in the existing literature. Hardy, Hall and colleagues (2001) found that some athletes reported negative ST to be motivational and Van Raalte, Morrey, Cornelius, and Brewer (2015) found marathon runners to use negative ST for motivation. Additionally, Hardy, Roberts and colleagues (2009) found individuals to report to a similar degree both positive and negative consequences following the use of negative ST. Although previous explanations for the motivational function of negative ST have suggested that it is the result of individual differences (e.g., Hardy et al; Hardy, Hall et al.), the content of negative ST may also play a role. In the present study, cue words such as “I’m going slow” and “I am sucking” were perceived as motivational by several participants, cue words such as “my legs are tired” and “I have a long way to go” were never perceived to be motivational. Although it was beyond the scope of this study, it would be interesting to inquire into these differences further. One possibility is that negative statements that can be changed by increased effort are more likely to be perceived as motivational. Referring to the previous example, the participant who says “I’m going slow” could change this by increasing the pace. Other common examples of negative ST that was perceived as motivational included “I’m doing terrible” and “I suck”, both of which can be changed with increased effort. Alternatively, the negative cue words that were not perceived as motivational were those that could not be changed by increased effort, and were often
statements that became more realistic with increased effort. Examples of these are “my legs are tired” and “I’m uncomfortable”.

The difference between ST content and function highlights the fact that ST is interpretative (Hardy, 2006). If the same ST statement was given to two individuals, it is possible that one would interpret it as facilitative and the other as debilitative. Therefore, it is important that individuals take part in developing their cue words. Previous studies have relied on assigning cue words to individuals (e.g., Theodorakis et al., 2000) in order to establish control between groups. Although this method controls for the content of ST, it has no control over the perceived function. The present study was able to control for both content and interpretation because the participants worked collaboratively with the researcher in developing the cue words. In order to use a specific cue word, the researcher had to determine if it met the group condition by content, and the participant ensured it was interpreted according to the function of that group. Therefore, it is recommended that future research allows the participants to play an active role in selecting their ST.

5.6 Limitations

There are a few limitations to the study that should be noted. First of all, the population consisted of university students with limited cycling experience. This limits the generalizability of the findings to athletic populations looking to improve sport performance. However, this population does allow the findings to be generalized to exercise settings for university students. Additionally, novices who are unfamiliar with cycling are unlikely to be familiar with the best pacing strategies. Therefore, these individuals may pace themselves differently than individuals familiar with cycling.
Another limitation with regards to the population was the grouping of males and females together. There was a significant difference in performance between males and females, which was to be expected. However, males and females also employed different pacing strategies, which may be attributed to the different gearing assigned to each sex.

Using a predictive value for VO\textsubscript{2}max is another limitation of the study. However, a direct method of measurement was unavailable. Given that the predictive values were primarily used for stratification purposes, their incorporation strengthened the sorting of groups, without affecting the overall analysis.

Furthermore, the duration of the intervention was a limitation to the study. Each participant took part in developing their ST plan before the cycling task, but they had limited time to practice using their cue words. Providing the participants with more time to practice using their cue words may have made the interventions more effective. However, due to the number of participants in the study and time requirements, a longer intervention was not possible. To compensate for this limitation, the participants took part in familiarization tasks and were provided with prompts of their cue words.

Finally, although the participants were instructed to give their best effort during the task, no incentive was provided to them. Therefore, it is possible that the participants did not provide their maximum effort on the task. However, incentives were not provided because they may have interfered with the motivational qualities of the assigned ST.

5.7 Future Considerations

In order to better generalize these findings to sport, future studies should examine the effect of challenging ST for cycling athletes. These athletes differ in their endurance
capabilities, as well as familiarity with pacing. Therefore, it would be worthwhile to determine if similar results would occur with cyclists.

Additionally, it would be worthwhile to examine the effectiveness of ST interventions on shorter and longer duration tasks. In the present study, the significant difference was found in the final time block, when the participants did not have to consider their pacing to the same extent. Examining the effectiveness of these interventions on a shorter task would help determine if challenging ST is more beneficial when an individual is providing a maximum effort without having to consider pacing. Alternatively, examining the influence of ST on a longer task would help determine if group differences would continue to increase over time.

Finally, it may be worthwhile to compare negative ST content that is perceived as facilitative, and negative ST that is perceived as debilitative. Both a descriptive and an experimental approach to this investigation would be valuable, and would help to clarify the existing literature on negative ST in sport. Although descriptive studies have shown that some negative ST is perceived as motivational (Hardy, Hall et al., 2001; Van Raalte et al., 2015; Hardy, Roberts et al., 2009), they have not compared the differences in the content between negative ST that is motivational and negative ST that is not. If differences between perceived motivational negative ST and other negative ST is identified, experimental studies can determine if these perceived differences lead to performance differences. Finally, if no content difference exists between negative ST that is perceived as motivational, and negative ST that is not, then it suggests that individual characteristics account for the inconsistencies in the effects of negative ST.
5.8 **Practical Implications**

Learning to challenge your negative ST can be an effective strategy for enhancing endurance performance. It is common practice for sport psychology consultants to develop ST plans that emphasize positive ST. However, negative thoughts occur naturally, particularly in difficult or stressful situations, like when an individual is experiencing high levels of fatigue. Therefore, it can be difficult for athletes to completely eliminate the occurrence of negative ST. If an athlete reports having difficulty with negative ST, instead of trying to ignore it, the practitioner can teach the athlete to embrace it. Further research is needed to determine exactly when this is the best solution, but the present study provides preliminary evidence that teaching individuals to challenge their negative ST can help their endurance performance, particularly in the final stages.
CHAPTER 6
CONCLUSION

In conclusion, this study demonstrated that negative ST can be used in a way to enhance performance for individuals in a fatigued state. The study provided evidence that teaching an individual to challenge their negative ST can be an effective strategy for handling negative thoughts during endurance tasks.

Additionally, the results indicate that time within an endurance task is a moderator of the ST-performance relationship. Specifically, as individuals become more fatigued, challenging ST may be the most effective type of ST to use because it can maintain ST consonance while providing motivation. Finally, the study suggests defining ST more precisely, by using the suggestion of Theodorakis and colleagues (2012) to define the valance of ST according to content, and use the terms facilitative and debilitative for function.
REFERENCES


APPENDIX 1

ETHICS: Informed Consent Form, PAR-Q, Debrief

Informed Consent

To Whom It May Concern:

You are invited to participate in a research study that is examining the effects of cue words on a cycling task.

Participation includes two sessions. The first session will take approximately 45 minutes. During this time your height and weight will be collected, you will fill out the Physical Activity Readiness Questionnaire (PAR-Q), and perform a VO$_{2\text{max}}$ test. The VO$_{2\text{max}}$ test involves cycling until voluntary exhaustion, starting at a low resistance and gradually getting higher.

The second session will take place within 2 weeks following the first and will take approximately one hour. During this time you will be assisted in developing cue words and will write out these cue words ten times to gain familiarity with them. These cue words will be used during a low intensity 5-minute warm up, followed by a 20-minute cycling task where you will cycle as far as you can in the given time. During the cycling, your VO$_2$ will be measured and every 5 minutes you will be asked to report how often you used the cue words. At the end of the task you will be asked to recite the cue words you were assigned.

All of the data collected is confidential. Only the primary researcher Chris DeWolfe and his supervisor Dr. David Scott will have access to it. Once all of the required data is collected from you, your name will be replaced with a number code so that you cannot be identified from the data. All data will be presented in a group format. Group data and the final study will be emailed to participants if they wish to see it once the study is complete. All data will be kept for 5 years in a secure office after the results have been completed, and the final study presented for any publication reasons.

Your participation is completely voluntary. Volunteers must be at least 19 years of age, or 18 years of age and enrolled in a university class. At any point you can withdraw from the study. You can also withdraw any data you provided. Withdraw in any of these ways is without consequence to you.

There is no known harm to participation; however, you may feel fatigued when performing the VO$_{2\text{max}}$ test and cycling task and may experience muscle soreness in the days following these tasks. One potential benefit is that using self-talk cues have been shown to help improve athletic performance and you can apply these cues in your own athletic endeavours if you wish.
Primary Investigator: Chris DeWolfe; Graduate student, UNB Kinesiology. chris.dewolfe@unb.ca

Supervisor: Dr David Scott; Professor, UNB Kinesiology. scotty@unb.ca

Participants may contact those mentioned below if they have any questions or concerns about the research. These individuals are not directly related to the research.

* Chair UNBF Research Ethics Board: Dr. Steven Turner, turner@unb.ca

* Director of Graduate Studies in Kinesiology: Dr. Usha Kuruganti, ukurugan@unb.ca

This project has been reviewed by the Research Ethics Board of the University of New Brunswick and is on file as 2015-114.

I, the undersigned, have read and understand the above conditions, and agree to participate in the research study. By signing, I acknowledge that I am at least 19 years old, or at least 18 years old and registered in a university class.

Name: ___________________________  Age: __________

E-mail: ______________________________________

Signature:_____________________________  Date : _____/_____/______
PAR-Q & YOU

(A Questionnaire for People Aged 15 to 69)

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

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

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

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

If you answered YES to one or more questions
Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.
- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

NO to all questions
If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:
• start becoming much more physically active — begin slowly and build up gradually. This is the safest and easiest way to go.
• take part in a fitness appraisal — this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

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

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

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

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

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

NAME
SIGNATURE
DATE
WITNESS

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

Thank you for participating in the study!

As you know, the purpose of the study was to examine the effects of cue words on cycling performance. You were involved in one of four groups of self-talk that were looked at. The four groups were positive, neutral, negative, and negative-challenging. If you wish to learn more about the other forms of self-talk, feel free to ask Chris DeWolfe, the primary researcher.

Each group was unaware that the study was comparing various forms of self-talk. This was to make it easier for each group to use the type of self-talk they were assigned, rather than one of another group. For instance, if an individual in the negative self-talk group knew they were compared to a positive self-talk group, they may be inclined to use positive ST because they think it will help them on the cycling task.

If you wish to receive a copy of the group results, and a copy of the completed study, please email the primary researcher at chris.dewolfe@unb.ca and the results will sent when available. If you wish to remove your data from the study, you may do so within two weeks following today (the completion of participation). If you chose to remove your data, you can do so without any consequence.

Thank you again for your participation!

Chris DeWolfe

I, the undersigned, have read and understand that the nature of the study was to compare the effects of four different self-talk groups on a cycling task.

Name: ______________________  ______ Age: ______

Signature:___________________________ Date : ___/___/____

I ________________________________ give consent for my data to be used for the purpose of this research, including any publication reasons.

I ________________________________ do not give consent and wish to withdraw my data, and I know this will not result in any consequence to me.
APPENDIX 2 SELF-TALK USE SCALE

Not at All  Somewhat Frequently  Consistently
CURRICULUM VIATE

Christopher Edward John DeWolfe

Universities attended:

University of New Brunswick, 2013-2016, Master of Science in Sport and Exercise Science

Acadia University, 2009-2013, Bachelor of Kinesiology with Honours

Conference Presentations:
