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Deborah L. Feltz
Major professor

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GOOD INTENTIONS GONE BAD: EXPLORING IRONIC EFFECTS IN SPORT

By

James A. Afremow

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ABSTRACT

GOOD INTENTIONS GONE BAD: EXPLORING IRONIC EFFECTS IN SPORT

By

James A. Afremow

The purpose of this dissertation was to examine Wegner's (1994) theory of ironic processes of mental control with respect to failures in self-regulation during motor skill performance. In order to investigate the implications of this theory in the contexts of "choking" and "relaxing," billiards students (N = 96) were randomly assigned to a "try not to choke" group, a "try to relax" group, or to a control group. All participants took three blocks of 15 attempts toward a target on a billiards table. In addition, half of the participants from each group received a mental load manipulation (i.e., counting backwards) during the second trial block, while all participants received the same mental load during the third trial block. Results showed that relative to pretest performance, the control group's shooting accuracy improved during the second block. However, the shooting accuracy of the two experimental groups remained constant. Although the mental control instructions did not decrease performance, these findings are supportive of ironic process theory. Mental load did not moderate the relationship between mental control instructions and shooting accuracy. Results did not support the expectation that releasing mental control would be effective as an intervention strategy to interrupt ironic processes.

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CHAPTER I

INTRODUCTION

Statement of the Problem

There are numerous times when athletes are confronted with distracting thoughts, unsettling emotions, or a strong desire to avoid certain types of performance mistakes. During these times, an attempt is often made to exert control over these thoughts, feelings, and behaviors. However, despite good intentions, efforts at mental control occasionally backfire - producing the opposite effect of that which is wanted. Moreover, this seems to occur during inopportune moments, such as when the level of stress is high.

In an attempt to account for such paradoxical or counter-intentional effects, Wegner (1994a) proposed the theory of ironic processes of mental control. Several empirical studies have provided evidence to support Wegner's theory across many domains, such as thought suppression (Wegner, Schneider, Carter, & White, 1987), concentration (Wegner & Erber, 1992), and pain control (Cioffi & Holloway, 1993). Although Wegner's theory has much potential to contribute to the field of sport psychology, few studies have been conducted to investigate ironic mental processes in a sport context (Janelle, 1999).

The purpose of this dissertation was to further apply Wegner's theory of ironic processes to sport. Specifically, this study explored the relationship between ironic effects of mental control and sport performance in two areas – "trying not to choke" and "trying to relax." Three major questions arose from these two areas. The first question this study addressed was whether "trying not to choke" and/or "trying to relax" could

backfire and produce performance decrements. The second question was whether mental load would increase these ironic effects. The third question was whether releasing mental control would interrupt these ironic processes from transpiring.

Nature of the Problem

Mental control is necessary for regulating thoughts, emotions, and behaviors. According to Wegner (1994a), two complimentary processes are initiated during mental control – an intentional operating process and an ironic monitoring process (see Figure 1). Specifically, the role of the operating process is to create the desired mental state, while the role of the monitoring process is to find evidence of any mental contents inconsistent with the desired state and to notify the operating process of the need for action. The operating process is more demanding of mental effort and can break down under mental load or stress. When the operating process is compromised, the monitoring process becomes more influential as the contents for which it is searching become more accessible. Thus, the mental control we usually enjoy can turn against us when we need it most.

Consider, for instance, the case of an athlete trying not to make a particular error in performance. Generally, performance unfolds according to plan when the athlete thinks, feels, and behaves in the intended manner. However, when the athlete is under load, such as extreme fatigue, the ironic monitoring process becomes more influential and may promote the undesired state of mind that inadvertently contributes to the manifestation of what was to-be-avoided.

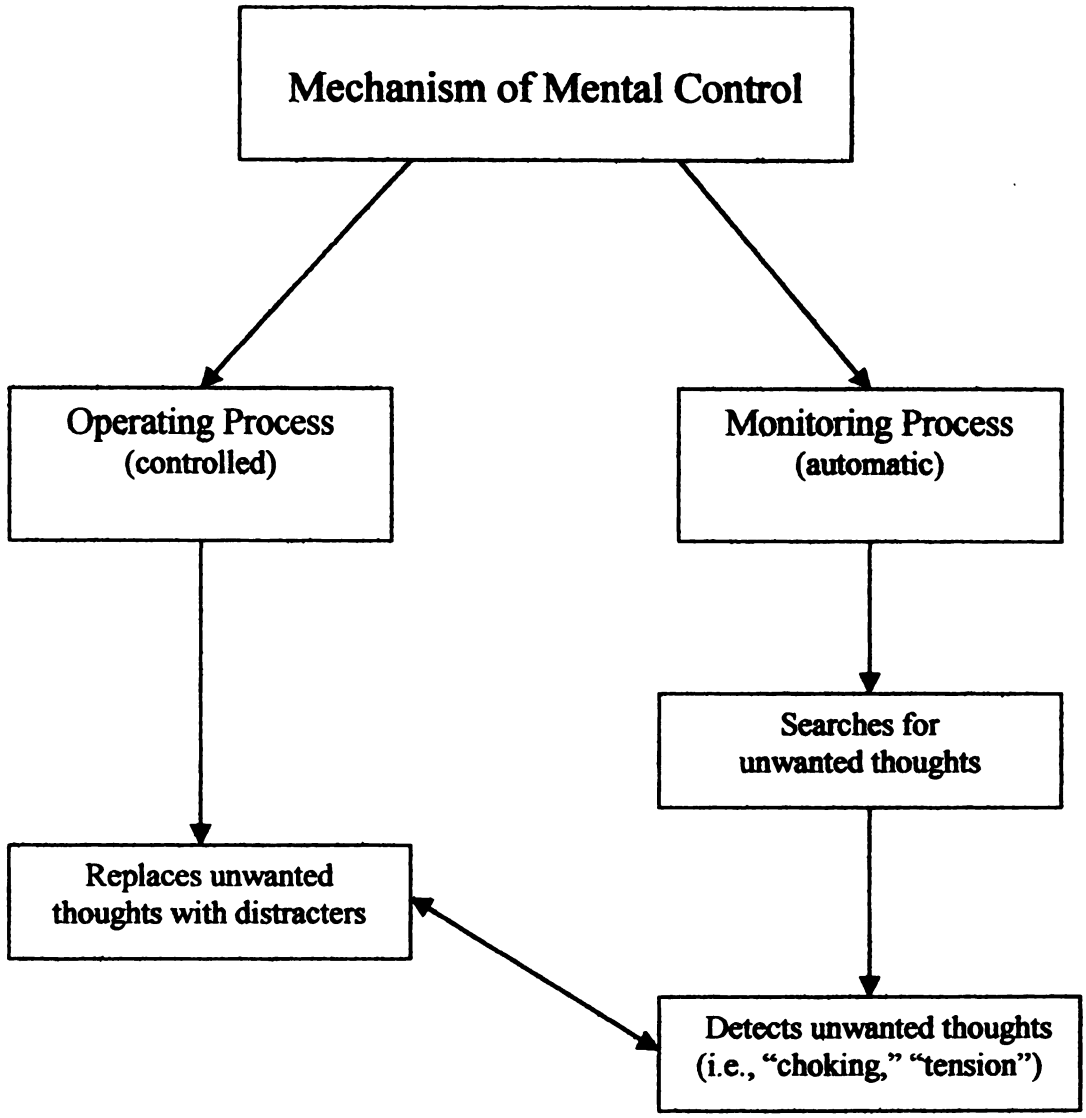


Figure 1. Illustration based on Wegner's dual-process theory of mental control.

Wegner, Ansfield, and Pilloff (1998) performed two experiments providing support for ironic effects in the mental control of movement that has relevance to sport performance. In the first experiment, participants instructed not to overshoot a target spot in a golf-putting task were more likely to err in this unwanted manner when under mental load. In the second experiment, participants instructed not to swing a handheld pendulum in an unwanted direction were more likely to do so under both mental and physical load conditions. However, three subsequent studies failed to fully replicate these findings (Beilock, Afremow, Rabe, & Carr, 2000; Braffman, Kirsch, Milling, & Burgess, 1997; Janelle, Murray, de la Pena, & Bouchard, 1999).

Mental control and choking. Begel (2000) identified choking as one of five types of performance problems in sport. Although choking has no universal definition, in the sport psychology literature it is generally understood as a decline in performance under situations that increase the desirability for a positive outcome (Baumeister, 1984). Thus, "choking under pressure" is often used to describe this paradoxical performance effect.

Several theories and hypotheses have been proposed or applied in an attempt to explain the causes of choking. These include drive theory (Hull, 1943; Spence & Spence, 1966); inverted-U hypothesis (Yerkes & Dodson, 1908); zone of optimal functioning (Hanin, 1980); cusp catastrophe model (Hardy & Fazey, 1987); cue-utilization theory (Easterbrook, 1959); and self-focus hypothesis of choking (Baumeister, 1984).

Baumeister (1984) argued that choking is the result of attention turned inward. Specifically, he found evidence suggesting that pressure to perform well shifts attention to the process of performance, thereby disrupting the automaticity of the skilled response. For

example, individuals low in dispositional self-consciousness were more likely to choke under pressure than those accustomed to high self-consciousness.

Recently, Lewis and Linder (1997) investigated two attentional processes postulated to account for the phenomenon of choking: the self-focus hypothesis and the distraction hypothesis. In contrast to Baumeister's self-focus hypothesis outlined above, the distraction hypothesis postulates that pressure shifts attention toward task-irrelevant information resulting in performance decrements. However, results supported the self-focus hypothesis in that choking under pressure occurred for participants not adapted to self-awareness, while this effect was attenuated under increased cognitive load, which served as a distracter.

Leith (1988) sought to explore coaching behaviors that contribute to the choking response. Specifically, he explored the effects of discussing choking on performance. Interestingly, participants in the experimental condition experienced a choking response as performance declined. Leith's findings indicated that simply talking about choking leads to its occurrence. However, Leith provided no explanation for this curious result.

The idea that athletes experience performance problems under self- or other- instruction not to make an unwanted action is not a new concept. For example, Suinn (1980) noted that it is important for instructors to emphasize thoughts, emotions, and behaviors regarding what to do, rather than what to avoid. Additionally, Janelle (1999) provided common sport examples of this concept, as when a golfer thinks not to hit the ball in the water and then proceeds to hit this unwanted shot.

While some plausible explanations for choking are provided above (e.g., Lewis & Linder, 1997), Leith's (1988) finding that simply talking about the choke leads to its occurrence is

not directly accounted for by these theories. However, there are several indicators that may provide an appropriate conceptual framework for interpreting choking in Leith's experiment.

Athletes are well aware of the stigma surrounding choking and often attempt to avoid this unwanted response from happening. For example, Lewis and Linder (1997) reported that participants in the pressure condition made spontaneous verbalizations including, "Don't choke!" In fact, in the study by Leith (1988), participants were told following the discussion about choking, "Don't let that bother you." Thus, it is plausible that efforts to avoid choking may have contributed to the choking response (i.e., decreased performance).

This study applied Wegner's theory of ironic processes of mental control to the phenomenon of choking in sport. Specifically, it investigated whether trying not to choke could produce ironic effects that hinder performance, and whether the manifestation of such effects would be increased by the presence of mental load. Next, the issue of ironic processes and relaxation will be considered.

Mental control and relaxation. The arousal-performance relationship is one of the most extensively studied concepts in the sport psychology literature. Many of the theories presented above for explaining the phenomenon of choking under pressure (e.g., inverted-U hypothesis; Yerkes & Dodson, 1908) were developed to explain the more general relationship between arousal and performance. Regardless of the particular theory, it is generally accepted that there exists an optimal level of arousal depending on the athlete and task (Gould & Krane, 1992).

A concept related to arousal level is muscular tension. For example, excessive muscular tension can be detrimental to athletic performance (e.g., Williams & Harris, 1998). Consequently, sport psychologists frequently employ relaxation techniques and

exercises in their work with athletes to decrease arousal levels and to reduce muscular tension when it is too high. In fact, a common refrain in sport is to "relax" when an athlete appears to be tight or is in a pressure situation.

However, the attempt to relax can sometimes backfire, producing greater levels of arousal or muscle tension (Heide & Borkovec, 1983). For example, Wegner, Broome, and Blumberg (1997) found evidence of ironic effects for participants trying to relax under stress. Specifically, participants employing progressive muscle relaxation under mental load experienced increased arousal as measured by their skin conductance level. However, the effect on athletic performance of trying to relax under mental load has not yet been investigated.

Therefore, in addition to exploring the issue of choking, this dissertation also applied Wegner's theory of ironic processes of mental control to trying to relax with respect to athletic performance. Specifically, it examined whether trying to relax would produce ironic effects of added tension hindering performance, and whether the manifestation of such effects would be increased by the presence of mental load. Next, the issue of intervention strategies to interrupt ironic processes will be considered.

Interrupting ironic processes. The evidence for ironic effects across several domains of mental control suggests that the attempt to make things better sometimes makes them worse. In Wegner terminology, the antidote becomes the poison (Wegner, 1997). However, understanding the etiology and mental architecture of ironic processes is an important first step toward developing interventions to interrupt ironic processes.

Wegner (1989) noted that direct or "naked" suppression is not possible. In other words, people lack the ability to empty their head and simply wish away an unwanted

thought, never to be bothered by it again. Thus, following failed attempts to suppress a thought, people will often engage in self-distraction (i.e., think of "B" or "C" instead of "A").

For example, participants instructed to suppress thoughts of a white bear reported attempts to think about anything other than a white bear (Wegner et al., 1987). However, thoughts of a white bear repeatedly returned, thus renewing the process of self-distraction. In fact, participants in this group were unable to completely avoid thinking about a white bear, and exhibited a later preoccupation with the to-be-avoided thought.

In a second experiment, participants were provided with a single distracter (e.g., red Volkswagen) for use during suppression. This strategy of focused self-distraction was shown to be more effective than the unfocused self-distraction typically employed by participants not receiving any instruction. According to Wegner et al. (1987), with only one replacement thought (i.e., red Volkswagen), fewer associations are made limiting a rebound of the to-be-avoided thought.

Although focused self-distraction can provide temporary relief from unwanted thoughts, Wegner (1989) cautioned against the habitual use of this strategy to ward off thinking about that which is unwanted. Specifically, it was argued that self-distraction can become nothing more than self-avoidance, limiting personal growth.

Consequently, Wegner (1989) proposed that it might be important to "stop stopping" (p. 174) and confront the unwanted thought. It follows that if mental control is not initiated then neither will be the ironic monitoring process. Thus, stopping attempts at suppression might end the cycle of creating an obsession. As Wegner (pp.179-180) wrote:

> When we try not to think of a white bear, after all, it seems we are just playing a simple game. This thought is surely something we can stop in a moment, we think to ourselves, and so we give it a try. All too soon we find, though, that it won't go away so easily. We try again. And it comes back again. If only we could realize that it will go away only when we welcome it back. It is only then that, like any child with a toy, we will soon tire of dragging it around with us and lose track of it quite naturally.

In support of this notion, Wegner (1989) reviewed therapeutic approaches that successfully employed similar methods in the treatment of emotional disturbance. For example, anxious patients provided with a half-hour worry period at the same time and place each day, in which to focus on their unwanted thoughts, showed a marked decrease in anxiety symptoms compared to a control group at the end of a 4-week treatment program (Borkovec, Wilkinson, Folensbee, & Lerman, 1983).

Thus, in addition to searching for ironic effects in the mental control of trying not to choke and trying to relax, this dissertation investigated the efficacy of releasing mental control (i.e., stop stopping) as an intervention strategy. Specifically, it examined whether releasing mental control would successfully reduce ironic effects from transpiring under conditions of mental load.

Hypotheses

Two common expressions in sport are "don't choke" and "try to relax." This dissertation employed Wegner's theory to explore the potential for ironic effects resulting from efforts at mental control following these well-intended self- or other-instructions. In addition, this dissertation explored whether releasing mental control could interrupt these ironic processes. The model that guides this dissertation is illustrated in Figure 1. Specifically, the following hypotheses were tested:

1. Participants in the "don't choke" group would experience a significant decrease in shooting accuracy from pretest to posttest 1, as compared to the control group.
2. Participants in the "relax" group would experience a significant decrease in shooting accuracy from pretest to posttest 1, as compared to the control group.
3. Participants in the "don't choke" group experiencing mental load would experience a significant decrease in shooting accuracy from pretest to posttest 1, as compared to participants not experiencing mental load.
4. Participants in the "relax" group experiencing mental load would experience a significant decrease in shooting accuracy from pre- to posttest 1, as compared to participants not experiencing mental load.
5. Participants in the "don't choke" group would experience a significant increase in shooting accuracy from posttest 1 to posttest 2, compared to the control group.
6. Participants in the "relax" group would experience a significant increase in shooting accuracy from posttest 1 to posttest 2, compared to the control group.

Limitations and Delimitations

Participants in this study were students enrolled in a billiards class at Michigan State University, thus limiting the generalizability of the findings. Although the class was titled "Beginning Billiards," there existed a wide range of participants in terms of playing ability. This was due to the fact that no intermediate or advanced level billiards classes were available. Results of this study may not generalize to elite or completely novice players. Further, the results of this study may not generalize to open motor skills or strength tasks. It is also important to note that the performance task in the present study did not directly correspond to an actual shot that might be played during a billiards game. Rather, the shot was similar to the act of "lagging for break," performed prior to a series of games. However, being able to hit the cue ball accurately to the intended target (i.e., object ball) is naturally a vital aspect of play. Furthermore, the experiment was conducted in a "natural" setting on standard tables in an authentic billiards room.

Definitions

Choking. Choking, in a sport context, refers to performance decrements despite an increase in the desirability for optimal skill execution (Baumeister, 1984).

Closed motor skill. A closed motor skill is self-paced and performed in a relatively predictable and stable environment (Singer, 1980). The task employed in the present dissertation, which involves shooting a cue ball to a target, is an example of a closed motor skill.

Ironic processes. Ironic processes refer to paradoxical or counter-intentional effects arising during efforts at mental control (Wegner, 1994a).

Mental control. Mental control refers to the deliberate attempt by an individual to regulate a mental state (Wegner, 1994a).

Mental load. Mental load refers to any load or stress requiring attentional resources, and, as such, compromises the operating process (Wegner, 1994a).

Monitoring process. A hypothetical construct thought to responsible for detecting signs inconsistent with the desired mental state during efforts at mental control (Wegner, 1994a).

Open motor skill. An open motor skill involves reacting to events in a relatively unpredictable and unstable environment (Singer, 1980). A defensive player in baseball or softball reacting to a hit by the batter is an example of an open motor skill.

Operating process. A hypothetical construct thought to be responsible for creating the desired mental state during efforts at mental control (Wegner, 1994a).

CHAPTER II

REVIEW OF THE LITERATURE

Ironic process theory was developed by Wegner (1994a) to account for the intentional and counterintentional effects that transpire from efforts at mental control. To date, there have only been a limited number of empirical investigations that have examined the relationship between ironic processes and sport performance, despite the potential of this theory to contribute in a variety of ways to the field of sport psychology (Janelle, 1999).

This chapter begins with an outline of Wegner's dual-process model of mental control and theory of ironic processes. Evidence of ironic effects across several domains of mental control relevant to sport performance is provided and several methods of interrupting ironic effects are considered. A subsequent section provides a critique of ironic process theory, and presents some of the limitations in the extension of ironic process theory to sport. The chapter concludes by offering implications of ironic process theory for sport psychology.

Ironic Process Theory

The ironic process theory states that when mental control is initiated, processes that thwart self-regulation are a built-in component of such control (Wegner, 1994a). In this section, the dual-process model of mental control is outlined.

Definition of mental control. Mental control is initiated during attempts to regulate thoughts, emotions, and behaviors. According to Wegner (1994a), two processes are involved in mental control – an intentional operating process and an ironic monitoring process. Specifically, the operating process consciously attempts to create the desired

state (i.e., cognitive, emotive, or behavioral), while the monitoring process unconsciously searches for evidence of mental contents inconsistent with the desired state.

The operating process. According to Wegner's theory, the operating process takes place in consciousness as the individual engages in mental control. Specifically, the operating process is initiated in an attempt to guide attention to the most desirable mental state, rather than avoiding or removing unwanted items from consciousness. For example, in the case of thought suppression, the operating process searches for desirable thoughts rather than attempting to directly block out unwanted thoughts. Because the operating process requires effort and is a resource-dependent cognitive process, it is subject to interference when the attentional requirements of the task are too high or there are competing attentional demands such as distractions.

The monitoring process. According to Wegner's theory, the monitoring process activates the operating process when evidence is found indicating that the desired state has not been achieved. For example, the monitoring process searches continually for any unwanted item during thought suppression. The monitoring process operates in parallel with the operating process during mental control. However, the monitoring process functions outside of conscious awareness and is effortless, not requiring attentional resources. Consequently, it is not susceptible to disruption by attentional demands.

Mental load. According to Wegner's theory, the ironic aspect of this mental architecture arises when load or stress disables the operating process and the contents of the monitoring process are then made available to consciousness, making the individual more susceptible to the unwanted state. Consequently, the act of mental control under load can become "the seed of our undoing" (Wegner, 1999, p.10). In sport, examples of

mental load may include anxiety, time constraints, distractions, fatigue, and memory loading (see Janelle, 1999). Consider the case of an athlete who has become overly anxious prior to the "big" game. In an attempt to stave off anxiety, the athlete may deliberately attempt to suppress thinking about this emotional response and inadvertently increase the level of anxiety as a result. The operating process has become less influential due to the anxiety and the monitoring process has made the athlete more aware of the unwanted physiological state. As the operating process becomes increasingly less effective, an "exacerbation cycle" may develop which keeps this ironic process going (Shoham & Rohrbaugh, 1997, p.151).

Evidence of Ironic Effects

An increasing amount of research has provided evidence of ironic effects in mental control (see Wegner, 1994a). Specifically, these studies have explored ironic effects across several domains of mental control under load and no load conditions. Evidence has been provided to support Wegner's theory across a wide range of non-sport related domains, such as substance cravings (e.g., Salkovskis & Reynolds, 1994), memory (e.g., Macrae, Bodenhausen, Milne, & Wheeler, 1996), and stereotyping and prejudice (e.g., Monteith, Sherman, & Devine, 1998).

What follows is a brief discussion of evidence of ironic effects for those domains of mental control relevant to sport. Specifically, these are movement, image suppression, thought suppression, mood control, intentional relaxation, pain control, and concentration.

Ironies in movement. As noted by Janelle (1999), anecdotal reports of ironic effects in sport are "virtually endless" (p.208). In fact, mistakes in performance seem to occur

more often the harder we try to avoid them. However, only a few studies to date have examined ironic processes relative to movement and sport performance. Wegner et al. (1998) performed two experiments providing support for ironic processes in the mental control of action. In the first experiment, participants who were instructed to avoid overshooting the target spot in a golf-putting task were more likely to err in this unwanted manner under mental load. Specifically, the mental load condition involved keeping a six-digit number in mind. In the second experiment, participants who were instructed not to swing a handheld pendulum in an unwanted direction were more likely to do so under both mental and physical load conditions. Specifically, the mental load condition involved counting backward from 1,000 by 3s. The physical load condition involved holding a brick with the outstretched arm not involved with the pendulum. This manipulation was intended to simulate load found in physical activities such as work and sport. However, it is uncertain whether a more sport specific mental or physical load (e.g., physical exertion) would have produced different results.

In a second study, Braffman et al. (1997) evaluated, in part, Wegner's (1994) theory of ironic processes of mental control as a possible explanation for the Chevreul pendulum illusion (i.e., an ideomotor suggestion related to hypnosis). Participants imaged the pendulum moving in a wanted direction or tried to prevent it from moving in an unwanted direction under conditions of low and high load. Specifically, mental load involved counting backward by 3s. The authors stated that the findings failed to show that the pendulum movement resulted from ironic processes. However, no explanation for this interpretation was provided.

In a third study, Janelle et al. (1999), employed a golf-putting task to further explore Wegner's theory. They assigned participants to different types of load: cognitive, visual, auditory, and anxiety. Participants in the first experiment were instructed not to putt the ball short of the target, while participants in the second experiment were instructed not to putt the ball past the target. In contrast to the findings by Wegner et al. (1998) supporting ironic processes, overall results of this study indicated that participants, regardless of load type, did not leave their putts in the unwanted direction. In fact, participants were more likely to leave their putts short or long in accordance with the instructions. The authors argued that the participants, in their attempt to follow instructions, "overcompensated" by putting short or long. The authors did not discuss the nature of the different types of load and whether they were specific to sport.

While Wegner et al.'s (1998) findings indicated that ironic effects might be instrumental in understanding decrements in sport performance, Janelle et al.'s findings suggest that the relationship between ironic processes and sport performance might be more complex. Although participants in Janelle et al.'s study overcompensated with respect to their putting direction, this still may be interpreted as a performance decrement. Also, it is possible that participants overcompensated in an effort to avoid what would be considered ironic effects.

Ironies of image suppression. The use of mental imagery as a tool to enhance the learning and performance of sport skills has been a topic of much interest to sport psychologists, coaches, and athletes. Imagery is routinely used by non-elite and elite athletes in both individual and team sports at various levels of competition (Orlick & Partington, 1988). Both empirical and anecdotal evidence have shown that mental

imagery can facilitate motor skill performance (Driskell, Copper, & Moran, 1994; Feltz & Landers, 1983).

In contrast to the beneficial effects of positive imagery, empirical evidence shows that negative imagery (i.e., imaging failure) can hinder performance (Powell, 1973; Woolfolk, Murphy, Gottesfeld, & Aitken, 1985; Woolfolk, Parish, & Murphy, 1985). Although negative imagery may not be commonly experienced, especially by expert performers, these potentially disruptive images can and do occur (e.g., Barr & Hall, 1992; Hall, Rodgers, & Barr, 1990). Consequently, athletes may attempt to suppress negative images whenever they arise.

Beilock, Afremow, Rabe, and Carr (2000) examined Wegner's (1994a) ironic process theory in the context of mental imagery and the sensorimotor task of golf putting. The participants were novice golfers and the authors varied type of imagery instruction (i.e., positive, suppression, suppression-replacement) and frequency of imagery rehearsal (i.e., every putt, every 3rd putt). Results showed that relative to pretest performance, the positive imagery group's accuracy improved across imaging blocks regardless of imagery frequency. However, the accuracy of the suppression and suppression-replacement groups was moderated by imagery frequency. Specifically, there was a decline in performance when imaging before every putt, while there was an improvement in performance when imaging before every 3rd putt. This pattern of results suggests that frequency of use of suppressive imagery is related to performance. In contrast to predictions from ironic process theory, ball destinations were more likely to be overcompensations rather than instances of the to-be-avoided outcome. For example, participants instructed to not image overshooting the target resulted in putts left short of

the target. The authors noted that this pattern of results is similar to Janelle et al.'s (1999) finding that individuals overcompensate in overt performance when instructed to avoid a particular outcome. However, when Beilock et al. limited their analysis of ball destinations to the first putt taken after imagery instructions (as was the analysis in Wegner et al.'s (1998) study), participants receiving suppression imagery instructions were more likely to err in leaving the putt in the direction of the to-be-suppressed image. Based on their results, the authors suggested that ironic effects with respect to mental imagery might be temporary in nature, soon replaced by an overcompensation strategy during repeated trials. The intervention of replacing to-be-suppressed images with a positive image was not found to be successful in reducing decrements in performance. In contrast, Wegner et al. (1987) found that providing participants with a distracter thought during suppression was helpful in preventing a subsequent rebound effect of the to-be-suppressed thought.

Ironies of thought suppression. Negative and distracting thoughts are considered detrimental to proper execution in sport performance (see Zinsser, Bunker, & Williams, 1998). Van Raalte, Brewer, Rivera, and Petitpas (1994, as cited by Hall, Hardy, and Gammage, 1999) found that approximately 90% of the junior competitive tennis players they surveyed experienced negative self-talk 13 or more times per match. However, Wegner (1989) suggested that attempting to refrain from thinking an unwanted thought can result in a preoccupation with the to-be-suppressed thought. As noted earlier, participants who were instructed to "not think about a white bear" were unable to successfully suppress this thought (Wegner et al., 1987). Later, when participants were provided with an opportunity to think about a white bear they thought more about this

target thought than participants who were instructed to think about a white bear from the beginning. Wegner et al. referred to this later preoccupation as a postsuppression rebound effect. In a follow-up experiment, participants were provided with a single distracter (e.g., red Volkswagen) for use during suppression. The findings showed that participants provided with the distracter thought did not exhibit later preoccupation with the unwanted thought.

Wegner and Erber (1992) found evidence pertaining to the hyperaccessibility of suppressed thoughts under load. In Experiment 1, participants were instructed to make associations to word prompts while either suppressing a target word or concentrating on the target word. Those participants suppressing a target word under load (i.e., time pressure) responded with the target word (e.g., house) to related prompts (e.g., home) more frequently than those under no load and even participants who were concentrating on the target word. In Experiment 2, participants performed a modification of the Stroop (1935) color-word task. Participants suppressing thoughts of a word under high load (i.e., rehearse a 9-digit number) were slower to indicate the color in which the word was printed than participants suppressing thoughts of the word under low load (i.e., rehearse a 1-digit number) or even participants who were concentrating on the target word. The authors interpreted these findings as suggesting that the suppressed word is more accessible under load or when compared to a word on which the participant is trying to concentrate.

Ironies of mood control. High levels of either positive (e.g., excitement) or negative (e.g., anxiety) emotions experienced during competition can also be detrimental to athletic performance (see Landers & Boutcher, 1998). As a result, sport psychology

practitioners will often instruct athletes and coaches regarding the importance of "psyching-up" or "psyching-down" when needed. Moreover, emphasis is placed on maintaining confidence and eliminating negative emotions, such as anger. In the clinical domain, Wegner (1994a) noted that because of the unpleasant nature of emotional disturbances like general anxiety, panic disorders, and phobias, individuals with these and similar disorders are highly motivated to initiate mental control.

However, in support of ironic process theory, Navon (1994a) suggested that individuals attempting to avoid anxiety under stress, for instance, can experience a "snowball effect" resulting in increased anxiety. Wegner, Shortt, Blake, and Page (1990) found that suppression of exciting thoughts ironically increases physiological responses as indexed by skin conductance level. Moreover, Wegner, Erber, and Zanakos (1993) found evidence for reversals in mood states during efforts at mental control under load.

Thus, releasing mental control over mood states might reverse these ironic processes. As noted earlier, Borkovec et al. (1983) found that providing anxious patients with a half-hour worry period each day, in which to focus on their unwanted thoughts, displayed a marked decrease in anxiety symptoms compared to a control group at the end of a 4-week treatment program.

Ironies of intentional relaxation. Excessive muscular tension can impair athletic performance (e.g., Williams & Harris, 1998). Consequently, athletes under self- or other-instruction (i.e., coach, sport psychologist) often initiate mental control when experiencing too much tension. However, the attempt to relax under stress can often create the opposite of what is wanted (Wegner, 1994a). For example, Wegner et al. (1993) showed that intentional relaxation under conditions of load produced ironic

increases in tension as indexed by skin conductance level. Specifically, participants in the first experiment attempted progressive relaxation under low load (i.e., rehearse a 1-digit number) or high load (i.e., rehearse a 9-digit number). Participants in the second experiment attempted to relax using their own individual method under low load (i.e., assess neutral items) or high load (i.e., answer questions introduced as an intelligence test). Thus, consistent with ironic process theory, attempting to relax under load backfired and resulted in increased tension.

In a related domain, Ansfield, Wegner, and Bowser (1996) found evidence of ironic effects in attempted sleep. Specifically, participants instructed to fall asleep "as fast as you can" under high load (i.e., listening to loud music) took longer to fall asleep compared to those under low load (i.e., listening to soft music) or participants given the instruction to fall asleep "whenever you want." Thus, initiating mental control with respect to falling asleep can ironically produce "a bit of insomnia" (Wegner, 1994a, p. 45).

Ironies of pain control. Booth (1987, as cited by Heil, 1993) estimated that 17 million sports injuries occur each year among American athletes. Increasingly, the topics of injury and pain management have become of interest to the field of sport psychology (Taylor & Taylor, 1997). Sport psychology practitioners utilize a wide variety of nonpharmacological pain management strategies when working with these athletes (Taylor & Taylor, 1998). Pain focusing techniques may involve directing attention to the pain (i.e., association) or directing attention away from the pain (i.e., dissociation) (see Taylor & Taylor, 1998).

However, Cioffi and Holloway (1993) found evidence indicating that attempts to suppress pain can ironically magnify these sensations. In addition, Heil (1993) suggested that dissociation techniques in some rehabilitation situations might be counterproductive. Wegner (1994a) argued that the effectiveness of both strategies depends on whether the pain is acute or chronic. Cioffi (1993, as cited by Wegner, 1994a), found that dissociation is more effective for acute pain, while association is more effective for chronic pain. According to ironic process theory, initiating mental control for persistent pain would eventually result in the operating process becoming taxed, thereby creating a subsequent rebound effect or preoccupation with the pain.

Ironies of concentration. Orlick (1990) identified concentration and distraction control as two of the most important elements for excellence in sport. Specifically, findings have revealed that elite performers are more likely to attend to relevant stimuli and ignore irrelevant stimuli or distractions during performance (e.g., Singer, Cauraugh, Chen, Steinberg, & Frehlich, 1996). However, the attempt to suppress a thought or distraction can sometimes make it more available, and the attempt to concentrate can sometimes make distractions more accessible (see Wegner, 1994a). As noted earlier, Wegner et al. (1993) found that the to-be-suppressed thought or distracter becomes more accessible during suppression under load. Similarly, Janelle (1999) reviewed findings from Janelle, Singer, and Williams (1999) indicating that participants involved in an auto-racing simulation task were more likely to attend to distracters which they were instructed to ignore while under load.

Limitations of Research Using Ironic Process Theory to Explain Failures in Sport

Although the above findings strongly support the hypothesis that ironic process theory may be useful in explaining failures in self-regulation during sport performance, there are noteworthy limitations across all these studies. Perhaps the most important limitation relates to external validity and the generalizibility of the findings to sport, in general, and elite athletes, in particular. No study presented above directly tested ironic process theory in an actual sport context, employing a sport specific mental or physical load, with athletes serving as the participants. For example, the participants in Wegner et al.'s (1998) study were selected from a sample of undergraduates enrolled in an introductory psychology class. Likewise, although Janelle et al. (1999) employed a golf putting task, participants were not selected from a population of golf players. In addition, the task employed in both studies did not directly correspond to an actual golf putt, as participants putted across an artificial surface to a spot, rather than on a putting green with a cup as the target.

Interrupting Ironic Processes

Sholam and Rohrbaugh (1997) noted that researchers "now know a good deal about what ironic processes look like, less about why they occur, and too little about how to change them" (p. 151). Given that ironic effects span several domains of mental control, it is important to identify ways to combat them. An understanding of the dual-process model of mental control reveals several possibilities for developing an intervention. For example, Wegner (1994a) states that ironic processes are only initiated during mental control. Thus, when giving up attempts at self-regulation, the susceptibility to counterintentional effects should be eliminated. However, Wegner (1994a) noted that it

is unclear under what circumstances this approach would be most effective and exactly how rescinding mental control would be accomplished. It could be that, as Wegner et al. (1987) suggest, providing a distracter thought for use during thought suppression may eliminate a rebound effect or later preoccupation with the to-be-suppressed thought.

Janelle (1999) presented an overview of ironic process theory in the context of sport and provided several recommendations for helping athletes interrupt ironic processes. Specifically, Janelle suggested that sport psychologists can help athletes (1) reduce load, either by reducing task complexity or decreasing anxiety using stress management, (2) follow paradoxical interventions designed to disrupt the ironic monitoring process, (3) decrease reliance on the operating process by making skills more automatic, or (4) better understand the nature of this phenomenon.

In their invited commentary, Hall et al. (1999) provided a critique of the recommendations offered by Janelle (1993). First, the authors argued that reducing task complexity is not always possible or desirable, especially given that ironic effects are relatively infrequent. Also, the authors pointed out in reference to Jones (1995) that anxiety can be both debilitating and facilitative and should only be addressed with regard to the former effect. Second, the authors argued that paradoxical interventions, such as having the athlete focus on an unwanted thought, are extremely questionable. Third, the authors argued that automaticity is already a goal and telling the athlete to become better is of no practical value. Further, the authors argued that awareness of a phenomenon does not always result in any change, referring to social loafing (Huddleston, Doody, & Ruder, 1985) as an example. Instead, Hall et al. recommended that one possible solution

is to have athletes accept their unwanted thoughts, as opposed to dwelling on them or trying to suppress them.

Taylor (1999) also provided a commentary on Janelle's (1999) review of ironic process theory. Taylor made several recommendations for helping athletes to minimize ironic processes. For instance, he argued that whether the monitoring process is activated is often influenced by how the athlete processes negative events. Taylor provided an example of an athlete shooting an airball in basketball to illustrate this point. If the athlete interprets the airball emotionally (i.e., as an embarrassment), mental control will likely follow in an attempt to guard against this "embarrassing" outcome from happening again. However, if the airball is interpreted informationally, the athlete will be more likely to consider why this result happened and what corrections to make instead of trying to suppress what happened.

Wenzlaff and Wegner (2000) argued that individuals beset by unwanted thoughts should relinquish thought suppression for better methods of mental control, including learning to accept and express any unwanted thoughts. Consistent with this approach might be developing an attitude of detachment or distance from negative or unwanted thoughts; simply noticing them as thoughts to observe versus becoming frightened by them may work better.

Critique of Ironic Process Theory

Navon (1994b) argued that the theory of ironic processes fails to provide a definitive account of phenomena considered ironic or paradoxical. Specifically, Navon provided the following reasons: (1) ironic process theory is not as general as claimed, (2) ironic effects can be explained by other theories, (3) the concept of the monitoring process is

"functionally implausible," and (4) the existence of the monitoring process has not been empirically substantiated. According to Navon, the data collected in support of Wegner's theory only demonstrate the dependence of failures in self-regulation on load, which can be accounted for by many other theories. Specifically, Navon stated that ironic effects occur when the efficiency of voluntary attention and selectivity is compromised under load. In response, Wegner (1994b) argued that the general prediction of ironic process theory has been clearly substantiated.

Wenzlaff and Wegner (2000) considered other theoretical perspectives offered to account for ironic effects with regard to thought suppression. For example, the authors discussed the possible role of motivation in the postsuppression rebound effect. Martin, Tesser, and McIntosh (1993, as cited by Wenzlaff and Wegner, 2000) argued that the postsuppression rebound effect might be explained by the Zeigarnik effect (Zeigarnik, 1938; Lewin, 1951) as the result of goal interruption.

Hall et al. (1999) offered a critique of ironic process theory as applied to the context of sport and exercise. The authors began their commentary by questioning the advantage of relying on ironic process theory because "other theories (e.g., self-efficacy theory, Bandura, 1997; catastrophe theory, Hardy, 1990; theory of planned behavior, Ajzen, 1985) can equally or better explain some of these losses of mental control" (p. 221). However, Hall et al. did not provide a rationale for this assertion, except that "some of these theories have been subjected to considerable investigation in the sport and exercise domains" (p. 221). The authors also argued, with regard to Janelle's (1999) suggestions, that ironic processes are unable to completely account for such concerns as the "yips" in golf or why people fail to adhere to exercise programs. Moreover, the authors stated that

ironic effects are rare, especially in elite athletes, and ironic effects cannot be predicted, because mental control is usually effective under load.

Implications for Sport Psychology

As demonstrated in this review of the literature, ironic process theory (Wegner, 1994a) holds the potential to explain numerous failures in self-regulation that transpire in sport. Suinn (1980) suggested that instructors emphasize to the learner what to do, rather than what to avoid. Janelle (1999) explained that "the mind has great difficulty in ignoring negative commands" (p. 207). However, ironic process theory holds that good intentions regarding both what to do and what to avoid can backfire, especially when the individual is under load. Future research needs to be directed toward a better understanding of the nature of ironic effects in sport and methods to interrupt ironic processes, so that we can eventually minimize their impact.

CHAPTER III

METHOD

Participants and Design

After receiving approval from the University Committee on Research Involving Human Subjects (see Appendix A), a total of 96 male (N = 84) and female (N = 12) undergraduate students enrolled in an introductory billiards class at Michigan State University voluntarily served as study participants. Participants were randomly assigned to a "try not to choke" group (n = 32), a "try to relax" group (n = 32), or to a control group (n = 32). The design of this study was a 3 ("don't choke" group, "relax" group, control group) x 2 (load, no load) x 3 (pretest, posttest 1, posttest 2) repeated measures ANOVA.

Task

The task performed by each participant involved shooting a cue ball on a billiard table. Specifically, participants attempted to hit the cue ball from the head spot across the billiard table, rebound the ball off the foot rail, and then stop the ball on the center spot, marked by a white circle (see Appendix B). All participants reported that this was a novel task, as they had not performed it previously. A standard cue ball and cue were provided. The billiard table measured 4.5 ft. x 9 ft. The same billiard table was used for each participant.

A pilot study with 6 participants was performed to ensure that this task was appropriate for the experiment. One modification was made to the experimental task as a

result of the pilot study. Specifically, the shooting target was moved from the head spot at the front of the table back to the center spot (see Appendix B), as participants tended to overshoot the head spot with the ball then hitting the head rail. Participants in the pilot test indicated that they understood their respective instructions, and, as such, no changes were made.

Rationale for Billiards Task

Billiards provides an excellent vehicle to investigate ironic processes of mental control. Billiards is a closed motor skill, and, as such, offers a consistent and predictable environment. Thus, the performance task employed in the present study provides a tractable and precise way to assess shooting accuracy. This performance task might be considered similar in many ways to a golf putt or free throw shot in basketball.

Procedure

After providing informed consent (see Appendix C), participants were told that the purpose of the study was twofold: (1) to examine shooting accuracy across several trials of practice, and (2) to compare individual performance. These instructions represented an attempt to increase participant motivation to perform their best during the experiment.

Participants began with 10 warm-up attempts. Next, participants were told to perform as best they can for the next series of attempts, stopping the cue ball on the target or as close as possible. Specifically, this series served as the pre-test, consisting of 15 attempts. After each attempt, the experimenter recorded the distance the cue ball stopped from the target and then replaced the ball on the starting location (see Appendix D). However, when the cue ball hit an unintended rail (i.e., the side rail or the head rail),

the distance between this point and the target was recorded. The class instructor and a teaching assistant served as the experimenters.

Following the pre-test, participants were provided with a short break. At this point, the experimental groups were provided with specific instructions for posttest 1, as described below.

Choke group. Participants in this group were told, "Now, it is very important that you try your best not to think about choking while you perform. Don't think about choking." After completing the fifth and tenth attempts, participants were told, "Remember, try not to think about choking."

Relax group. Participants in this group were told, "Now, it is very important that you try your best to relax while you perform. Do your best to relax." After completing the fifth and tenth attempts, participants were told, "Remember, try your best to relax."

Control group. Participants in this group were not provided any additional instructions during posttest 1, other than those provided with the mental load manipulation, as described below.

Half the participants in each of the three groups were given a mental load during posttest 1. Specifically, these participants were told immediately prior to posttest 1, "Now, until I tell you to stop, and this is very important, I want you to start counting down from 1,000 by 7s (that is, 1,000, 993, 896, and so on). After I say stop at the end of the trial I will ask you what number you have reached." The mental load manipulation is identical to that which was successfully employed for an experiment performed by Wegner et al. (1998).

Except for adding the experimental manipulations described above, the pretest and posttest 1 tasks were identical. Posttest 1 also consisted of 15 attempts. To the participant, posttest 1 appeared to be just another series of attempts. Immediately following posttest 1, participants provided with the mental load were asked to report the current number in their countdown to determine if directions were followed. All participants reported numbers suggesting that directions were followed.

Following posttest 1, participants were provided with a short break. At this point, the experimental groups were provided with specific instructions for posttest 2, as described below.

Choke group. Participants in this group were told, "Now, you can just release your attempt at trying not to choke. Perform as best you can while accepting any thoughts you might happen to have, even if they are about choking. Just let them go away on their own without trying to block them out." After completing the fifth and tenth attempts, participants were told, "Remember, accept any thoughts you might be having."

Relax group. Participants in this group were told, "Now, you can just release your attempt at trying to relax. Let any relaxation happen on its own while you do nothing but perform as best you can." After completing the fifth and tenth attempts, participants will be told, "Remember, let any relaxation just happen."

Control group. Participants in this group were not provided any additional instructions during posttest 2, other than being provided with the mental load manipulation described above.

Except for modifying the experimental manipulations described above, the posttest 1 and posttest 2 tasks were identical. Posttest 2 also consisted of 15 attempts. To the

participant, posttest 2 appeared to be just another series of attempts. However, in contrast to posttest 1, all participants in posttest 2 performed under the mental load manipulation. Participants not performing under mental load during posttest 1 began counting backward from 1,000, while participants performing under mental load during posttest 1 continued counting backward from the number they reached during posttest 1. Immediately following posttest 2, all participants were asked to report the current number in their countdown to determine if directions were followed. All participants reported numbers suggesting that directions were followed.

At this point, all participants were administered a self-report post-experimental questionnaire (see Appendix E) and then fully debriefed (see Appendix F). Specifically, the post-experimental questionnaire assessed the effect of the manipulations on participants' performance.

CHAPTER IV

RESULTS

The results are presented in two sections. The first section reports descriptive and inferential statistics for the shooting accuracy scores. The second section reports descriptive and inferential statistics for self-report measures on the post-experimental questionnaire. A significance level of $p \leq .05$ was used for analyses in this study.

Shooting Accuracy

Shooting accuracy was measured by the distance (cm) away from the target that the cue ball stopped after each attempt. Table 1 contains means and standard deviations of shooting accuracy by group. The small number of female participants precluded any statistical comparisons between gender.

Table 1 means suggest that the control groups' performance improved from pre-test to posttest 1, but declined from posttest 1 to posttest 2. Performance of those participants in the relax group declined from pre-test to posttest 1, with no change in performance from posttest 1 to posttest 2. Performance of those participants in the choke group improved from pre-test to posttest 1 and from posttest 1 to posttest 2. Irrespective of group assignment, performance of those participants experiencing load at both posttest 1 and posttest 2 improved from posttest 1 to posttest 2, while performance of participants in the relax and control groups who only experienced load at posttest 2 declined from posttest 1 to posttest 2.

Table 1

Mean Distance from the Target (cm) by Group

Group		Shooting Accuracy (cm)					
		Pre-test		Post-test 1		Post-test 2	
	N	M	(SD)	M	(SD)	M	(SD)
Control	16	39.21	(12.10)	31.37	(11.28)	36.94	(9.71)
Control – Load	16	44.53	(18.52)	41.63	(10.96)	40.04	(12.34)
Total	32	41.87	(15.62)	36.50	(12.12)	38.49	(11.03)
Relax	16	35.34	(7.81)	36.66	(11.81)	38.22	(9.94)
Relax - Load	16	37.96	(11.33)	41.57	(11.48)	39.96	(10.23)
Total	32	36.65	(9.66)	39.11	(11.73)	39.09	(9.96)
Choke	16	37.21	(10.63)	37.19	(10.87)	36.57	(11.80)
Choke - Load	16	41.46	(12.02)	40.05	(9.42)	34.33	(11.52)
Total	32	39.33	(11.37)	38.62	(10.11)	35.45	(11.53)

To explore Hypotheses 1 through 4, shooting scores were submitted to a 3 ("don't choke" group, "relax" group, control group) x 2 (load, no load) x 2 (pretest, posttest 1) repeated measures ANOVA (see Appendix G for all ANOVA tables). There was no significant group x load x trial block interaction, F (2,90) = .62, $p > .05$, and no significant load x trial block interaction, F (2,90) = .70, $p > .05$. There was a significant group x trial block interaction, F (2,90) = 3.81, $p \leq .05$ (see Figure 2). Follow-up paired samples t-tests showed that the control group significantly improved in shooting accuracy from pretest to posttest 1, t (31) = 2.13, $p \leq .05$, ES = .38. In contrast, as can be seen from Figure 2, the performance of the "don't choke" and the "relax" groups was quite different. Shooting accuracy did not significantly change from pretest to posttest 1 for the "don't choke" group, t (31) = .41, $p > .05$, ES = .07, or for the "relax" group, t (31) = -1.49, $p > .05$, ES = .26. The pattern of means followed the ironic process theory prediction (Hypotheses 1 and 2), as efforts at mental control with respect to "choking"

and "relaxing" proved detrimental to normal performance improvement when compared to the control group (i.e., there was no improvement in performance).

Tests of between-subjects effects indicated that neither the treatment main effect, F (2, 90) = .15, $p > .05$, nor the interaction between treatment and load, F (2, 90) = .43, $p > .05$, were significant. However, there were significant between-group differences on mental load, F (1, 90) = .5.75, $p \leq .05$. Specifically, irrespective of group, participants experiencing mental load performed significantly worse than participants not experiencing load mental load. Although these findings suggest that load impacts performance, load failed to contribute to between group differences on shooting scores as predicted by ironic process theory. Thus, Hypotheses 3 and 4 were not supported.

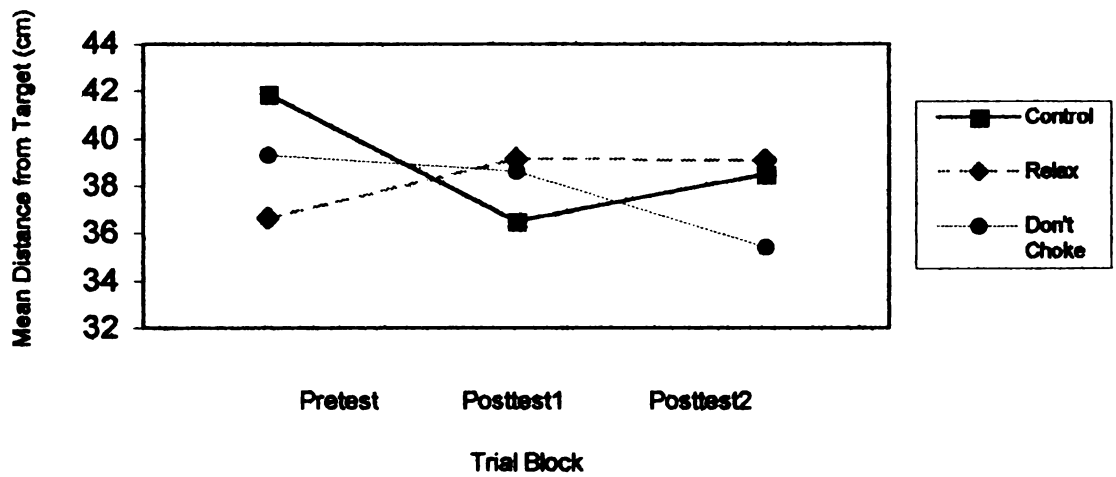


Figure 2. Mean distance from the target (cm) across trial blocks as a function of group.

To explore the effects of the intervention strategy of releasing mental control (Hypotheses 5 and 6), shooting scores were submitted to a 3 ("don't choke" group, "relax" group, control group) x 2 (load, no load) x 2 (posttest 1, posttest 2) repeated

measures ANOVA. There was no significant group x load x trial block interaction, F (2,90) = .37, $p > .05$, and no significant group x trial block interaction, F (2,90) = 2.51, $p > .05$. These findings failed to support Hypotheses 5 and 6 that releasing mental control would lead to improved performance. However, there was a significant load x trial block interaction, F (2,90) = 7.39, $p \leq .05$. Follow-up paired samples t-tests showed that those participants who had received load at posttest 1 and continued to receive load at posttest 2 significantly improved in shooting accuracy from posttest 1 to posttest 2, t (47) = 2.34, $p \leq .05$, ES = .34. In contrast, those participants experiencing load at posttest 2 for the first time did not significantly change in shooting accuracy from posttest 1 to posttest 2, t (47) = -1.52, $p > .05$, ES = .22. Thus, mental load failed to contribute to significant differences between groups, and appeared to have a learning effect from posttest 1 to posttest 2.

Given that there was a learning effect with respect to mental load, separate analyses were performed with only those participants in the no load condition to examine the effects of the mental control manipulation. Shooting scores were submitted to a 3 ("don't choke" group, "relax" group, control group) x 2 (pretest, posttest 1) repeated measures ANOVA, which produced a significant group x trial block interaction, F (2, 45) = 3.25, $p \leq .05$. Follow-up paired-samples t-tests exploring this interaction indicated that the no load control group significantly improved in shooting accuracy from pretest to posttest 1, t (15) = 2.53, $p \leq .05$, ES = 2.52. In contrast, as can be seen from Figure 3, shooting accuracy did not significantly change from pretest to posttest 1 for the no load "don't choke" group, t (15) = .01, $p > .05$, ES = .00, or for the no load "relax" group, t (15) = - .53, $p > .05$, ES = .13. These findings lend additional support to Hypotheses 1

and 2 that mental control with respect "trying not to choke" and "trying to relax" negatively effects performance.

Separate analyses were performed with only those participants in the no load condition to also examine the effects of the mental release manipulation. Shooting scores were submitted to a 3 ("don't choke" group, "relax" group, control group) x 2 (posttest 1, posttest 2) repeated measures ANOVA. There was no significant group x trial block interaction, $F(2, 45) = 1.66$, $p > .05$. Thus, the overall findings for the no load conditions were consistent with the combined load and no load conditions regarding shooting accuracy.

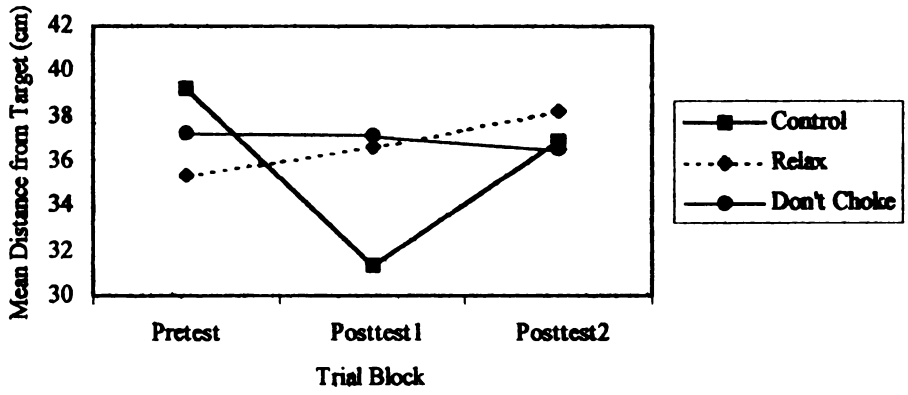


Figure 3. Mean distance from the target (cm) across trial blocks as a function of group (no load).

Post-Experimental Questionnaire

The post-experimental questionnaire was administered to each participant following completion of the study. In order to assess perceived skill level, participants were asked to report on a 7-point Likert scale their playing ability level for billiards. The scale ranged from 1 - "beginning," to 7 - "advanced," with 4 - "intermediate" as the mean.

There were no significant differences between the "don't choke" group ($M = 3.88$, $SD = .91$), the "relax" group ($M = 3.97$, $SD = 1.06$) and the control group ($M = 4.28$, $SD = .89$) with respect to perceived skill level, $F(2, 93) = 1.59$, $p > .05$.

As a manipulation check, participants in the "don't choke" group were asked to report how hard they tried not to choke during posttest 1, while participants in the "relax" group were asked to report how hard they tried to relax during posttest 1. A 7-point Likert scale was provided, ranging from 1 - "not at all," to 7 - "as hard as I could." The "don't choke" group ($M = 4.38$, $SD = 1.56$) reported significantly trying harder not to choke than the control group ($M = 2.34$, $SD = 1.56$), $t(62) - 2.03$, $p < .05$. And, the "relax" group ($M = 4.38$, $SD = 1.39$) reported significantly trying harder to relax than the control group ($M = 3.03$, $SD = 1.60$), $t(62) - 1.34$, $p < .05$.

Next, the perceived effects of the manipulations on participants' performance by group were assessed. Participants in the "don't choke" group were asked to report what effect the instruction "not to choke" had on their performance for posttest 1, and what effect the instruction "to just let go of trying not to choke" had on their performance for posttest 2. A 5-point Likert scale was provided for both questions, ranging from 1 - "very harmful," to 5 - "very helpful," with 3 - "no effect" as the mean. The mean for the mental control instruction was below the scale's mid-range ($M = 2.59$, $SD = .84$), while the mean for the mental release instruction was above the scale's mid-range ($M = 3.56$, $SD = .62$). One-sample chi-square tests were conducted to test the significance of the perceived effects of the mental control instructions "try not to choke" and "to just let go of trying not to choke". Results for both mental control, $\chi^2 (4, N = 32) = 28.63$, $p < .05$, and mental release, $\chi^2 (2, N = 32) = 10.75$, $p < .05$, instructions were significant.

Overall, with respect to the mental control instruction, 1 participant reported a "very harmful" effect, 16 participants reported a "harmful" effect, 11 reported "no effect", 3 reported a "helpful" effect, and 1 reported a "very helpful" effect. With respect to the mental release instruction, 16 participants reported "no effect", 14 participants reported a "helpful" effect, and 2 reported a "very helpful" effect. These frequencies demonstrate that more participants experienced the mental control instructions as harmful, rather than helpful. In contrast, while half of the participants experienced the mental release instructions as having no effect, the other half of participants reported that the instructions were helpful or very helpful.

Participants in the "relax" group were asked to report what effect the instruction "to relax" had on their performance for posttest 1, and what effect the instruction "to just let go of trying to relax" had on their performance for posttest 2. A 5-point Likert scale was provided for both questions, ranging from 1 - "very harmful," to 5 - "very helpful," with 3 - "no effect" as the mean. The mean for the mental control instruction was just above the scale's mid-range ($\underline{M} = 3.09$, $\underline{SD} = .73$), while the mean for the mental release instruction was farther above the scale's mid-range ($\underline{M} = 3.41$, $\underline{SD} = .67$). One-sample chi-square tests were conducted to test the significance of the perceived effects of the mental control instructions "to relax" and "to just let go of trying not to relax". While results for the mental control instructions were not significant, χ^2 (2, $\underline{N} = 32$) = 3.06, $\underline{p} > .05$, results for the mental release instructions were significant, χ^2 (3, $\underline{N} = 32$) = 21.75, $\underline{p} < .05$. Overall, with respect to the mental control instruction, 7 participants reported a "harmful" effect, 15 participants reported "no effect", and 10 reported a "helpful" effect. With respect to the mental release instruction, 2 participants reported a "harmful effect",

16 participants reported "no effect", 13 reported a "helpful" effect, and 1 reported a "very helpful" effect. These frequencies demonstrate that most participants experienced the mental control instructions as having no effect. In contrast, while most of the participants experienced the mental release instructions as having no effect, more participants reported that the instructions were helpful rather than harmful.

Participants in the "relax" group were asked to report on a 7-point Likert scale their level of activation during both posttest 1 and posttest 2. The scale ranged from 1 - "too relaxed," to 7 - "too tense," with 4 - "just right" as the mean. The mean response for posttest 1 was above the scale's mid-range ($\underline{M} = 4.53$, $\underline{SD} = .88$), while the mean response for posttest 2 was closer to the scale's mid-range ($\underline{M} = 4.19$, $\underline{SD} = 1.45$). One-sample chi-square tests were conducted to test whether the number of participants in the "relax" group were likely to be equal across the activation levels at posttest 1 and posttest 2. Results for both posttest 1, χ^2 (3, $\underline{N} = 32$) = 12.25, $\underline{p} > .05$, and posttest 2, χ^2 (2, $\underline{N} = 32$) = 3.06, $\underline{p} > .05$, were significant. With respect to posttest 1, 5 participants reported an activation level of "3", 8 participants reported an activation level of "4 - just right", 16 reported an activation level of "5", and 3 participants reported and activation level of "6". With respect to posttest 2, 2 participants reported an activation level of "1 - too relaxed", 3 participants reported an activation level of "2", 3 reported an activation level of "3", 8 reported an activation level of "4 – just right", 12 reported an activation level of "5", 3 reported an activation level of "6", and 1 participant reported an activation level of "7 – too tense." These frequencies demonstrate that most participants perceived themselves more tense than relaxed during posttest 1, and, at posttest 2, participants were

more likely to report activation levels of "4 - just right" or "5", which is in the direction of "too tense."

Participants in the "don't choke" group were also asked to report on the same 7-point Likert scale as the "relax" group their level of activation during both posttest 1 and posttest 2. The response for posttest 1 was slightly above the scale's mid-range ($\underline{M}$ = 4.50, $\underline{SD}$ = 1.48), indicating an activation level of "tense." In contrast, the response for posttest 2 was closer to the scale's mid-range ($\underline{M}$ = 4.03, $\underline{SD}$ = .86), indicating an activation level of "just right." The mean response for participants in the control group when asked to indicate their activation level for the overall experiment was above the scale's mid-range ($\underline{M}$ = 4.44, $\underline{SD}$ = .67). One-sample chi-square tests were conducted to test whether the number of participants in the "don't choke" group were likely to be equal across the activation levels at posttest 1 and posttest 2. Results for both posttest 1, χ^2 (6, $\underline{N}$ = 32) = 15.25, $\underline{p} > .05$, and posttest 2, χ^2 (4, $\underline{N}$ = 32) = 21.13, $\underline{p} > .05$, were significant. With respect to posttest 1, 2 participants reported an activation level of "1 – too relaxed", 1 reported an activation level of "2", 4 reported an activation level of "3", 7 participants reported an activation level of "4 - just right", 9 reported an activation level of "5", 8 reported and activation level of "6", and 1 participant reported and activation level of "7 – too tense." With respect to posttest 2, 1 participant reported an activation level of "2", 7 reported an activation level of "3", 15 reported an activation level of "4 - just right", 8 reported an activation level of "5", and 1 participant reported an activation level of "6." These frequencies demonstrate that most participants perceived themselves more tense than relaxed during posttest 1, and, at posttest 2, participants were more likely to report activation levels of "4 - just right."

With respect to the mental load manipulation, participants in each group were asked to report what effect counting backwards had on their performance. A 5-point Likert scale was provided, ranging from 1 - "very harmful," to 5 - "very helpful," with 3 - "no effect" as the mean. The mean for the control group ($M = 2.78$, $SD = 1.07$), the "relax" group ($M = 2.63$, $SD = .91$), and "don't choke" group ($M = 2.72$, $SD = 1.05$) were slightly below the scale's mid-range suggesting a slightly "harmful" effect. A one-way ANOVA was performed on these means, failing to produce a significant group effect, $F(2, 93) = .20$, $p > .05$.

CHAPTER V

DISCUSSION

The purpose of this dissertation was to explore Wegner's (1994a) theory of ironic processes of mental control with respect to "choking" and "relaxing" in a sport context. Three main questions were addressed: (1) With respect to "trying not to choke" and/or "trying to relax" during motor skill performance, can mental control backfire and interfere with performance? (2) Does the presence of mental load increase the extent to which these ironic processes interfere with performance? (3) Can releasing mental control prevent or interrupt these ironic processes from transpiring?

Mental Control and Shooting Accuracy

Analysis of shooting accuracy from pretest to posttest 1 showed that the control group experienced a significant improvement in performance, while the shooting accuracy for both the "don't choke" and the "relax" groups remained constant. Although the mental control instructions did not decrease performance, these findings are supportive of ironic process theory. Specifically, the "don't choke" group and the "relax" group each failed to demonstrate the normal performance improvement with repeated practice that was experienced by the control group.

Self-report measures provided additional support for the ironic process theory. When asked to report on the post-experimental questionnaire what effect the instructions "not to choke" had on their performance, the mean response of the "don't choke" group was below the scale's mid-range indicating that participants in this group perceived the instructions as having a "harmful" effect. Moreover, several of the open-ended responses to this question were also revealing. For example, one participant from this group wrote,

"I thought about choking instead of the shot," and another participant observed, "The word (choke) occasionally popped into my head."

However, self-report measures for the "relax" group were mixed. When asked to report on the post-experimental questionnaire what effect the instruction to "relax" had on their performance, the mean response of the "relax" group was just above the scale's mid-range indicating that the participants in this group perceived the instructions as having "no effect." Open-ended responses to this question were likewise mixed in terms of the effectiveness of this instruction. For example, one participant stated, "I seemed to think about the next shot better and I took a deep breath before it," while another participant wrote, "Trying to relax and count messed up my overall concentration."

When asked to indicate on the post-experimental questionnaire what their level of activation was during the second set of attempts, the mean response of the "relax" group was above the scale's mid-range, indicating that they were more "tense" than "relaxed." It is interesting to note that the "don't choke" group reported a similar mean response to this question. This suggests that tension may have been a contributing factor to a lack of improved performance from pretest to posttest 1 for both groups.

It is therefore unlikely that the failure of the "relax" group to improve their shooting accuracy from pretest to posttest 1, in contrast to the control group, can be attributed to becoming "too relaxed" as a result of their instruction to "try their best to relax" (see Yerkes & Dodson, 1908). In fact, based on the self-report measures, participants in this group reported an activation level higher than would be desired, following the ironic process prediction.

One limitation of the present study is that the ironic effect of mental control was only assessed via shooting accuracy and self-report measures of activation level and perceived effectiveness of the manipulation. Using a psychophysiological measure, such as skin conductance level (SCL), may have provided specific information about changes across trial blocks with respect to mental control. For example, Wegner et al. (1996) found ironic increases in SCL for participants trying to relax under load. Also, measuring grip pressure to detect changes in muscle tension might be useful in future investigations. In addition, with respect to the experimental design, the present study did not assess variable error with respect to ball destination. As such, it is uncertain whether mental control instructions differentially impacted whether the ball ended long or short of the target or strayed from the midline. Understanding whether athletes will over- or under-shoot the target could provide additional awareness about how ironic processes impact athletic performance.

On a practical note, it would be informative to examine athletes with different levels of expertise to compare their susceptibility to ironic processes, as well as strategies used to overcome unwanted thoughts (e.g., "choking") or successfully induce the relaxation response while performing. However, as experts have developed greater automaticity in their execution (Proctor & Dutta, 1995), it would follow that these performers would have more attentional resources to allocate to stress or load without compromising the operating process and unleashing the ironic monitoring process, compared to their novice or intermediate counterparts.

Mental Load and Shooting Accuracy

Analysis of shooting accuracy showed that the mental load manipulation had a significant negative impact on performance. However, mental load did not moderate the relationship between mental control instructions and shooting accuracy, in contrast to the ironic process theory. It is important to note that ironic effects have also been observed without mental load (e.g., Wegner et al., 1987).

Although the mental load manipulation failed to significantly contribute to the production of ironic effects in the present dissertation, the experiment itself cannot be considered to be without any stress or load. The testing was evaluative in nature and either the class instructor or teaching assistant served as the experimenter. Thus, the instructions to "try not to choke" or "try to relax" were not out of character for this type of situation. Additionally, self-report by participants in the combined load and no load control group indicated that for the experiment their mean level of activation was above the scale's mid-range in the "tense" rather than the "relax" direction. It is possible that there was sufficient load to produce the pattern of means from pretest to posttest 1 following the ironic process prediction, without requiring the mental load manipulation.

It is also important to consider the type of load employed in the present study. Although the findings suggest that counting backwards had a marginally detrimental effect on performance, some participants reported that it had either no effect or was in fact beneficial to their performance. For example, one participant wrote that counting backwards was helpful because, "It took my mind off everything else." Perhaps some participants released their mental control of "trying not to choke" or "trying to relax" and concerned themselves more with keeping track of counting. However, it is unknown

whether a more sport specific type of load (e.g., anxiety, fatigue, time constraints) would have strengthened the pattern of ironic effects observed in the present study (see Janelle, 1999).

Mental Release and Shooting Accuracy

Wegner et al. (1987) found that individuals provided with a specific distracter thought for use during attempted suppression of an unwanted target thought were less likely to have a rebound or later preoccupation with the target thought. However, he later cautioned against the habitual use of self-distraction to ward off thinking about that which is unwanted because it can be self-limiting, instead Wegner suggested to "stop stopping" or release mental control and confront that which is unwanted (Wegner, 1989). The third question in this dissertation addressed whether releasing mental control with respect to "trying not to choke" or "trying to relax" can interrupt ironic processes and facilitate performance.

Although results failed to show that the mental release intervention did not significantly improve performance, some individual participant self-reports indicated that the intervention was helpful. For example, one participant in the "don't choke" group who had reported that during posttest 1 "The word (choke) kept popping up in my head" stated for posttest 2 that "The word (choke) stopped popping up in my head." Other participants in the "don't choke" group reported that this instruction reduced "pressure." One participant in the "relax" group stated for posttest 2 that "[I] didn't have to think about relaxing, [I] just let it come naturally." In addition, the overall mean response of the "don't choke" group and the "relax" group regarding the effect of the mental release

instructions were above the scale's midrange, suggesting that the intervention was perceived favorably.

It is also important to note that neither the "don't choke" group nor the "relax" group experienced a postsuppression rebound or preoccupation with the unwanted target following mental release as would have been indicated by a decline in shooting accuracy from posttest 1 to posttest 2. Thus, stopping thought suppression once initiated was not found detrimental to subsequent performance.

The concept of mental release as presented in this dissertation is similar to Hall et al.'s (1999) suggestion that it might be helpful for athletes to interrupt ironic processes by learning to accept negative thoughts when they occur. The authors noted that this does not imply dwelling on negative thoughts. This approach was compared to what Rotella (1995) had stated about understanding that golf is not a game of "perfect" and that it is important to learn to accept mistakes so as to proceed with play. It is also noteworthy to mention that for thousands of years practitioners of Eastern philosophy have earned to rid themselves of unwanted thoughts during meditation by letting them go rather than trying to push them away (see Kabat-Zinn, 1994).

In contrast, sport psychology practitioners have traditionally utilized techniques such as thought stoppage to help athletes eliminate negative or distracting thoughts (Zinsser et al., 1998). Wegner (1989) argues against this approach, referring to studies that demonstrate its failure in therapeutic contexts (e.g., Reed, 1985). However, comparing the efficacy of mental release and techniques such as thought stoppage in a sport context requires further investigation.

Conclusion

The present study revealed that instructions "not to choke" and "to relax" had ironically proved detrimental to shooting accuracy. Thus, additional support for ironic process theory was found. However, although mental load was detrimental to performance, it failed to moderate the effects of mental control instructions. It is possible that a more sport specific type of mental load may have produced different results. In addition, although results did not support the efficacy of releasing mental control, individual participant responses suggest that mental release may have some promise as an effective intervention strategy against ironic processes. Perhaps, in this study the mental release instructions may have proved more beneficial if, as part of the experimental design, participants had received some training regarding the nature of ironic processes and how the intervention was intended to combat them.

In sport, although mental control usually contributes to the athlete's desired effect, there are times when it leads to the very errors, fumbles, or miscues that the athlete sought most to avoid. Armed with a greater understanding of ironic processes, sport psychologists will eventually be able to help athletes reduce their good intentions from going bad.

Suggestions for Future Research

Hall et al. (1999) argued that ironic effects "occur relatively infrequently, especially in elite athletes" (p. 221). Future research on this topic should consider the extent to which ironic effects occur in sport, and whether differences exist between elite and non-elite athletes. It is also important to ascertain the impact of different types of sport specific load on ironic processes. In the present study, a non-sport specific load (i.e., counting

backwards) was not found to moderate ironic effects. Moreover, as stated above, future research should explore and compare alternative intervention strategies intended to offset the adverse effects of ironic effects on sport performance.

APPENDICES

APPENDIX A

University Committee on Research Involving Human Subjects Approval

MICHIGAN STATE
UNIVERSITY

April 17, 2000

TO: Deborah L. FELTZ
138 IM Sports Circle
Dept. of Kinesiology
MSU

RE: **IRB# 00-210** CATEGORY:1-A, 1-C

APPROVAL DATE: April 17, 2000

TITLE: GOOD INTENTIONS GONE BAD: EXPLORING IRONIC EFFECTS IN SPORT

The University Committee on Research Involving Human Subjects' (UCRIHS) review of this project is complete and I am pleased to advise that the rights and welfare of the human subjects appear to be adequately protected and methods to obtain informed consent are appropriate. Therefore, the **UCRIHS approved this project.**

RENEWALS: UCRIHS approval is valid for one calendar year, beginning with the approval date shown above. Projects continuing beyond one year must be renewed with the green renewal form. A maximum of four such expedited renewals possible. Investigators wishing to continue a project beyond that time need to submit it again for a complete review.
REVISIONS: UCRIHS must review any changes in procedures involving human subjects, prior to initiation of the change. If this is done at the time of renewal, please use the green renewal form. To revise an approved protocol at any other time during the year, send your written request to the UCRIHS Chair, requesting revised approval and referencing the project's IRB# and title. Include in your request a description of the change and any revised instruments, consent forms or advertisements that are applicable.
PROBLEMS/CHANGES: Should either of the following arise during the course of the work, notify UCRIHS promptly: 1) problems (unexpected side effects, complaints, etc.) involving human subjects or 2) changes in the research environment or new information indicating greater risk to the human subjects than existed when the protocol was previously reviewed and approved.

If we can be of further assistance, please contact us at 517 355-2180 or via email: UCRIHS@pilot.msu.edu. Please note that all UCRIHS forms are located on the web: http://www.msu.edu/unit/vprgs/UCRIHS/

Sincerely,

David E. Wright, Ph.D.

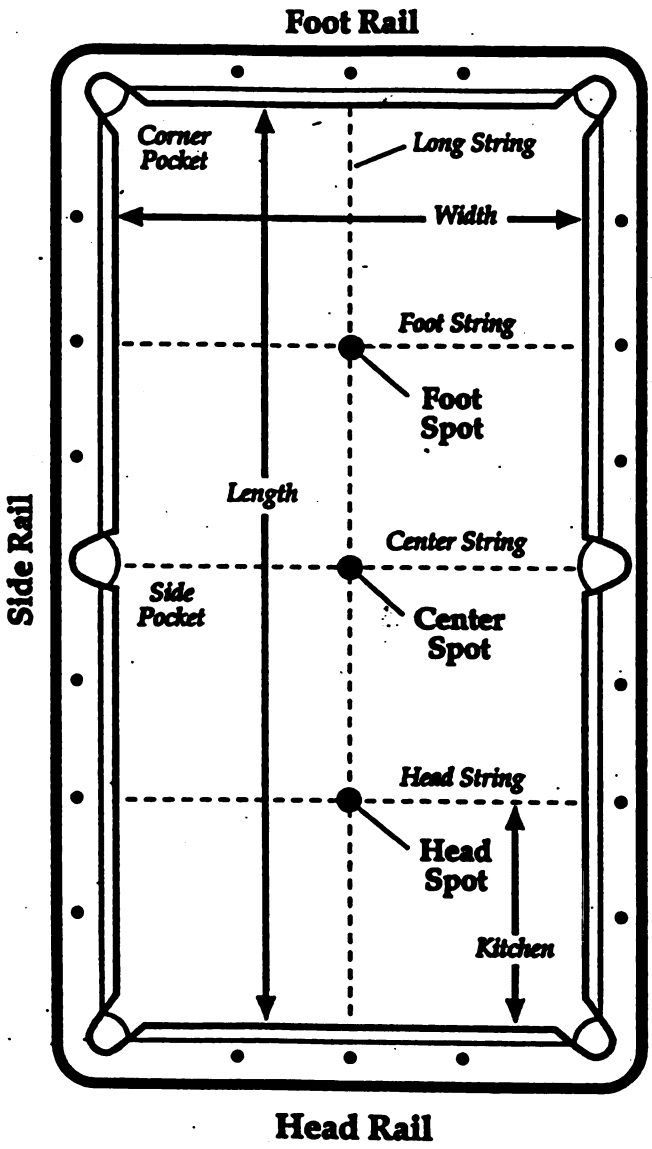
DEW: bd

cc: James Afremow
Room 39 IM SPORTS CIRCLE
MSU

OFFICE OF
RESEARCH AND GRADUATE STUDIES
sity Committee on lesearch Involving Human Subjects
iigan State University
ministration Building
st Lansing, Michigan
48824-1046
517/355-2180
FAX: 517/353-2976
msu.edu/user/ucrihs
ail: ucrihs@msu.edu

APPENDIX B

Table Diagram


Foot Rail
Corner Pocket
Long String
Width
Foot String
Foot Spot
Length
Side Rail
Center String
Side Pocket
Center Spot
Head String
Head Spot
Kitchen
Head Rail

APPENDIX C

Consent Form

APPENDIX C:

Consent Form

Dear Participant,

I would like to request your participation in this research study I am conducting through the Department of Kinesiology at Michigan State University. Specifically, this project will help me fulfill part of the requirements for my Doctoral Degree. Your participation in this study may contribute to our knowledge about how psychological processes affect athletic performance, and, as such, your cooperation is valuable and appreciated. This project aims to investigate the influence of instructions on the accuracy of shooting a cue ball across several trials of practice. In addition, you will be asked to complete a brief questionnaire regarding your performance. Total participation time for the study will be approximately 30 minutes.

Your participation is voluntary. Whether you choose to participate in this study will not affect your class grade. At any time, you may discontinue your participation or not answer specific items on the questionnaire without penalty. If you have any questions you can ask the experimenter at any time. Participation involves minimal psychological risk, and no benefits are guaranteed. Data obtained during the experiment will be treated with strict confidence and you will remain anonymous in any report of the results. On your request, the results can be forwarded to you upon project completion.

If you have any questions about this project, you can contact:

James Afremow, M.S., M.A., LLPC
Doctoral Candidate
Department of Kinesiology
Michigan State University
(517) 432-7121 or e-mail: afremowj@pilot.msu.edu

Deborah Feltz, Ph.D.
Professor and Department Chair
Department of Kinesiology
Michigan State University

If you have any concerns about how this research was conducted, you can call:
Dr. David Wright at (517) 355-2180

If you understand the nature of the project and the nature of your participation and consent to participate in this project, please print and sign your name below.

Name (Print): _____ Signature: _____

Date: _____

APPENDIX D

Performance Recording Sheet

APPENDIX D:

Performance Recording Sheet

Group: _____

Participant Name: _____ Date: _____

Experimenter: JA / MK
Term: SP / SU

PRETEST	POSTTEST 1	POSTTEST 2
1) _____	1) _____	1) _____
2) _____	2) _____	2) _____
3) _____	3) _____	3) _____
4) _____	4) _____	4) _____
5) _____	5) _____	5) _____
6) _____	6) _____	6) _____
7) _____	7) _____	7) _____
8) _____	8) _____	8) _____
9) _____	9) _____	9) _____
10) _____	10) _____	10) _____
11) _____	11) _____	11) _____
12) _____	12) _____	12) _____
13) _____	13) _____	13) _____
14) _____	14) _____	14) _____
15) _____	15) _____	15) _____

APPENDIX E

Post-Experimental Questionnaire

APPENDIX E:

Post-experimental Questionnaire

"Don't choke" Group

Name: _____

Age (DOB): _____

Gender: M / F

Directions: Each question below refers to your performance. Please circle the number for the most appropriate response. Do not mark between the numbers.

1. How would you rate your playing ability level for billiards?

1	2	3	4	5	6	7
Beginning			Intermediate			Advanced

2. What effect did counting backwards have on your performance?

1	2	3	4	5
Very harmful	Harmful	No effect	Helpful	Very helpful

Please explain:

3. How hard did you try not to choke during your second set of attempts?

1	2	3	4	5	6	7
Not at all						As hard as I could

4. What was your level of activation during your second set of attempts?

1	2	3	4	5	6	7
Too relaxed			Just right			Too tense

5. What effect did the instructions not to choke have on your performance?

1	2	3	4	5
Very harmful	Harmful	No effect	Helpful	Very helpful

Please explain:

6. What effect did the instructions to let go of trying not to choke and accept any thoughts about choking have on your performance?

1	2	3	4	5
Very harmful	Harmful	No effect	Helpful	Very helpful

Please explain:

7. What was your level of activation during your third set of attempts?

1	2	3	4	5	6	7
Too relaxed			Just right			Too tense

APPENDIX E:

Post-experimental Questionnaire

"Relax" Group

Name: _____

Age (DOB): _____

Gender: M / F

Directions: Each question below refers to your performance. Please circle the number for the most appropriate response. Do not mark between the numbers.

1. How would you rate your playing ability level for billiards?

1	2	3	4	5	6	7
Beginning			Intermediate			Advanced

2. What effect did counting backwards have on your performance?

1	2	3	4	5
Very harmful	Harmful	No effect	Helpful	Very helpful

Please explain:

3. How hard did you try to relax during your second set of attempts?

1	2	3	4	5	6	7
Not at all						As hard as I could

4. What was your level of activation during your second set of attempts?

1	2	3	4	5	6	7
Too relaxed			Just right			Too tense

5. What effect did the instructions to relax have on your performance?

1	2	3	4	5
Very harmful	Harmful	No effect	Helpful	Very helpful

Please explain:

6. What effect did the instructions to let go of trying to relax and just let it happen on its own have on your performance?

1	2	3	4	5
Very harmful	Harmful	No effect	Helpful	Very helpful

Please explain:

7. What was your level of activation during your third set of attempts?

1	2	3	4	5	6	7
Too relaxed			Just right			Too tense

APPENDIX E:

Post-experimental Questionnaire

C Group

Name: _____

Age (DOB): _____

Gender: M / F

Directions: Each question below refers to your performance. Please circle the number for the most appropriate response. Do not mark between the numbers.

1. How would you rate your playing ability level for billiards?

1	2	3	4	5	6	7
Beginning			Intermediate			Advanced

2. What effect did counting backwards have on your performance?

1	2	3	4	5
Very harmful	Harmful	No effect	Helpful	Very helpful

Please explain:

3. How hard did you try not to choke?

1	2	3	4	5	6	7
Not at all						As hard as I could

4. How hard did you try to relax?

1	2	3	4	5	6	7
Not at all						As hard as I could

5. What was your level of activation?

1	2	3	4	5	6	7
Too relaxed			Just right			Too tense

APPENDIX F

Debriefing Script

APPENDIX F:

Debriefing Script

There are times when athletes try not to think, feel, or behave in a specific manner. For example, an athlete may be experiencing a distracting thought, negative emotion, or have a desire not to make a particular error in performance. These efforts at mental control are usually helpful. However, there are times when these intentions backfire and the unwanted thought, feeling, or behavior is manifested. The purpose of this study is to explore these effects under different conditions. Your participation will help provide a better understanding of when efforts at mental control are beneficial and when they might be avoided. Please direct any specific questions regarding your participation to the experimenter. Thank you again for your participation.

APPENDIX G

ANOVA Summary Tables

APPENDIX G:

ANOVA Summary Tables

TABLE 1

Analysis of Variance of Shooting Scores from Pre-test to Posttest 1

Source	SS	df	MS	F
		Between subjects		
Group	62.82	2	31.41	.15
Load	1217.40	1	1217.40	5.75*
Group X Load	182.60	2	91.30	.43
Error	9065.15	90	211.84	
		Within subjects		
Trial Block	70.08	1	70.08	1.08
Group X Trial Block	496.48	2	248.24	3.81*
Load X Trial Block	45.37	1	45.37	.70
Group X Load X Trial Block	81.03	2	40.52	.62
Error	5864.14	90	65.16	

* $p < .05$.

TABLE 2

Analysis of Variance of Shooting Scores from Posttest 1 to Posttest 2

Source	SS	df	MS	F
		Between subjects		
Group	150.52	2	75.26	.38
Load	567.19	1	567.19	2.86
Group X Load	325.43	2	162.71	.82
Error	17847.08	90	198.30	
		Within subjects		
Trial Block	7.79	1	7.79	.18
Group X Trial Block	215.95	2	107.97	2.51
Load X Trial Block	317.24	1	317.24	7.39
Group X Load X Trial Block	31.95	2	15.97	.37
Error	3865.93	90	42.96	

* $p < .05$.

TABLE 3

Analysis of Variance of Shooting Scores from Pre-test to Posttest 1 (No Load)

Source	SS	df	MS	F
		Between subjects		
Group	185.86	2	92.93	.37
Error	11195.03	45	248.80	
		Within subjects		
Trial Block	1.34	1	1.30	.02
Group X Trial Block	185.82	2	92.91	1.33
Error	3153.32	45	70.07	

TABLE 4

Analysis of Variance of Shooting Scores from Posttest 1 to Posttest 2 (No Load)

Source	SS	df	MS	F
		Between subjects		
Group	197.62	2	98.81	.52
Error	8622.32	45	191.61	
		Within subjects		
Trial Block	112.81	1	112.81	2.38
Group X Trial Block	157.60	2	78.80	1.66
Error	2135.45	45	47.45	

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