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## A Source of Choking under Pressure: The Ironic Effect of Self-Talk in a Hand Motion Steadiness Task

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THE FLORIDA STATE UNIVERSITY  
COLLEGE OF EDUCATION

A SOURCE OF CHOKING UNDER PRESSURE: THE IRONIC EFFECT OF SELF-TALK IN  
A HAND MOTION STEADINESS TASK

By  
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For my wife, Cen, who supports me wholeheartedly on my path of seeking the truth while keeps me balanced as a happy person.

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## ABSTRACT

The purpose of the study was to investigate how attentional focus affect hand motion steadiness under different pressure levels and to explore the accuracy of skin conductance level (SCL) in measuring one's pressure level. Undergraduate college students (40 males, 40 females) were recruited to perform a hand motion steadiness task for two blocks (i.e., baseline and test) of 10 trials. The order of the blocks was counterbalanced within four subgroups classified by two between-participant factors: pressure, attentional focus. The pressure level was manipulated by whether participants were notified about a time constraints (which were not actually applied) in their performance and the attentional focus factor whether participants were instructed to do a task-focused self-talk ("Go Steady") or suppressive self-talk ("Don't Shake"). Participants' SCL and ratings of pressure level were obtained for both blocks. Results revealed that the ironic process did lead participants rehearsing repressive self-talk ("Don't Shake") to choke regardless of the pressure level. Besides, SCL seems to be more of an indicator for one's activation-arousal level than pressure level. Finally, females have a more steady hand under various conditions than males. These findings had both applied and theoretical implications and contributed to the research of choking under pressure.

## CHAPTER 1

### INTRODUCTION

It seems almost certain that Matthew Emmons, a US Olympic marksman, will always regard August 17, 2008 as a nightmare. He was competing in the men's 50 m rifle three positions final of Beijing 2008 Olympic Games on that day. Leading by 3.3 points, he needed merely a 7.6 shot to win the gold medal. However, Emmons got only 4.4 points on the last shot and dropped from top to the fourth place. Ironically, Emmons also enjoyed a great advantage in this event in the 2004 Athens Olympic Games, where he has previously experienced another failure of similar magnitude. The failure also happened in his last shot. This time he shot at the target of someone next to him and hence won no medal at all (Bao, 2008).

Was it merely bad luck for Emmons to twice experience failures of this magnitude? Or, was there something behind it? In the literature, there are at least two explanative lines of reasoning to explain the "Emmons' phenomenon". One is titled *Choking under Pressure* (see Beilock & Gray, 2007), the other *Theory of Ironic Process of Mental Control* (Wegner, 1994).

In sports psychology, choking under pressure is defined as suboptimal performance resulting from the desire to peak and win (Baumeister, 1984; Beilock & Gray, 2007). Beilock and Gray noted two points in the definition of the term. The first is tied to the notion of suboptimal performance, which was highlighted as being something other than a random fluctuation of one's skill level. Their second point concerned that the less-than-ideal performance occurred in response to a high pressure situation. Baumeister (1984) interpreted pressure as "any factor or combination of factors that increases the importance of performing well on a particular occasion" (p. 610). It seems likely that both of these matters have relevance to Emmons' example.

In cognitive psychology, the theory of ironic process of mental control (Wegner, 1994) upholds that the process undermining one's goal of mental control is often inherently linked to efforts to intentionally control mental states. That is, while an operating process directs an individual's efforts to achieve a mental state, a concurrent monitoring process unconsciously runs a counter-intentional search in order to find any failure of the operating system. Therefore, when the operating process is undermined somehow by mental load (such as pressure or anxiety), the monitoring process will emerge and eventually produce undesired results (Wegner, 2009), which can be either opposite or neutral to the goal of the mental state (Wegner, 1994).

Evidence of the ironic effect has been observed in many areas, relative to thought control (Wegner & Erber, 1992), relaxation (Wegner, Broome, & Blumberg, 1997), sleep (Ansfield, Wegner, & Bowser, 1996), mood (Wegner, Erber, & Zanakos, 1993), and even social taboos (Wegner, 2009). Sports settings, nevertheless, own the characteristic of having clear goals and high situational pressure, which meet all the necessary conditions of the theory of ironic process of mental control. And there has been quite a few articles (Janelle, 1999; Wegner, 1994; Wegner, Ansfield, & Pilloff, 1998; Wegner et al. 1997), which have implied that athletes in sports settings may well become victims of the ironic processes expounded by the theory. In retrospect, Mr. Emmons' Olympic performance outcomes appear to provide this view with anecdotal support.

Prior to their sport psychology counterparts (Binsch, Oudejans, Bakker, & Savelsbergh, 2009, 2010; Janelle, 1999), researchers (Wegner, 1994; Wegner et al., 1997) working in the cognitive area of psychology highlighted the potential value of the theory of ironic process of mental control in explaining choking under pressure. However, only little effort has been casted upon this nexus and extant research has varying setbacks (Beilock, Afremow, Rabe, & Carr, 2001; Dugdale & Eklund, 2003; Wegner et al., 1998). One example includes Wegner et al.

(1998)'s research. In Experiment 1, they had participants perform a golf putting task in a room lit merely by ultraviolet light. All the participants putted on an indoor carpet and the researchers instructed them to land the yellow-glowing ball on the blue-glowing target spot. Some participants performed with a putter glowing orange light (visual monitoring present), whereas others had a difficult-to-see black putter (visual monitoring absent) under the ultraviolet light. They did so to manipulate participants' visual monitoring of putting movement, because evidence indicates that the absence of visual monitoring is able to reduce the probability for ironic results to occur (Easton & Shor, 1975). They also manipulated mental load by having the participants keep a six-digit number in their mind throughout the experiment. The pitfall of this experiment, however, is the encroachment of ecological validity in return for visual monitoring manipulation, because hardly any sport is done in the absence of visual monitoring. In Experiment 2, Wegner et al. (1998) videotaped participants holding a pendulum. They manipulated mental load (by having participants count backward by 3s) as well as task instructions (i.e., prevent sideways movement vs. hold it steady). Although the results well-supported ironic processing theory of mental control, the experiment had several limitations: (a) reported observer inter-rater reliability was less than desirable (i.e.,  $r = .75$ ), (b) participants' arm position might have influenced the movement of the pendulum and there was no precise description of the arm direction apart from being hold parallel to the glass coordinate plate, and (c) while holding the pendulum, participants did not wear gloves which could eliminate their reported awareness of tactual feedback (cf. Easton & Shor, 1975). In addition, Wegner et al. (1998) created mental load either by requiring participants to mentally keep a six digit number throughout the experiment or to count backward from 1000 by 3s. These kinds of mental load are

not features of sports setting and hence further undermined the ecological validity of these studies.

In sum, previous research has shown the potential of the theory of ironic process of mental control in predicting behaviors defined by choking under pressure. However, there are quite a few limitations that hinder its development in sports setting. The purpose of current research is to overcome some shortcomings evident in extant research and thus advance the understanding of choking and its cognitive mechanism.

## CHAPTER 2

### LITERATURE REVIEW

In this chapter, two theoretical orientations towards choking under pressure (i.e., attentional theories of choking under pressure, theory of ironic process of mental control) are discussed. As well, theory of skill acquisition and attentional style model are reviewed with regard to their utility in connecting the two orientations. That is, the theory of ironic process of mental control could be a more profound theory (than the attentional theories of choking under pressure) in explaining choking. Lastly, self-talk is addressed considering its subtle role in directing one's attention and therefore self-talk can affect the process.

#### **Attentional Theories of Choking under Pressure**

Attentional theories seek to describe the cognitive mechanism governing pressure-induced failure: how pressure moderates the attention resources and memory structures sustaining performance (Beilock & Gray, 2007). Therefore, compared to other theories (such as drive theory), attentional theory holds the promise to capture the phenomenon of choking under pressure (Lewis & Linder, 1997). Attentional theory is comprised of (a) distraction theory, and (b) explicit monitoring theory; their respective nature and distinctiveness are discussed next.

#### **Distraction Theory**

“Distraction theories postulate that choking occurs because the performer fails to attend to and utilize information necessary for performance” (Baumeister & Showers, 1986, p. 365). In other words, pressure undermines performance by distracting one's resources of working memory to task irrelevant information.

Most of the evidence supporting distraction theories comes from research done in academic settings. Beilock et al. (2004), for example, assigned participants to either low- or high-pressure groups to perform novel modular arithmetic questions. Mathematical task of this sort should be susceptible to attention distraction, because it poses a high demand on working memory resources. The results showed that pressure elevated state anxiety and perceived pressure and participants' performance in the high-pressure group declined significantly compared to the performance of the low-pressure group.

Although distraction theories have received considerable support, Baumeister and Showers (1986) cautioned that distraction might not always be detrimental to performance. Sanders and Baron (1975), for example, proffered that on occasions distraction would turn on certain compensation (i.e., increased effort) within the performer and thus improve the performance.. Parallel to this point, not every task relies heavily on working memory capacity and resources. Some high-level motor skills (i.e., golf putting; baseball batting; soccer dribbling) in sports become proceduralized with practice (Beilock, Carr, MacMahon, & Starkes, 2002; Lewis & Linder, 1997; Masters, 1992) and thus should be (at least partially) immunized to distraction. Consequently, these types of skills may be influenced by other attention-induced disruptions when performers experience situational pressure.

### **Explicit Monitoring Theory**

Theories such as *Explicit Monitoring Theory* (Beilock & Carr, 2001), *Self-Focused Model* (Lewis & Linder, 1997), and the *Theory of Reinvestment* (Masters, 1992) suggest that pressure felt by the performer helps direct one's attention inward to oneself to avoid performance failure. In such a condition, self-focus shifts individuals' attention to gain stronger conscious control and monitoring than would be applied under a non-pressure circumstance (Baumeister,



1984; Beilock & Carr, 2001; Lewis & Linder, 1997). Self-focused attention is thought to disrupt well-learned or automatized motor skills that usually transpire unconsciously by bringing them back to consciousness and disassembling them (Beilock, Bertenthal, McCoy, & Carr, 2004).

There is a good amount of scientific evidence using high-level motor skills (i.e., golf putting; baseball batting; soccer dribbling) to examine the explicit monitoring theory (Beilock, et al., 2002; Lewis & Linder, 1997; Masters, 1992). Although these research can be roughly classified into two categories (one indirectly simulated the effect of pressure by experiment prescriptions; the other directly elicited pressure), the results unanimously supported what had been predicted by explicit monitoring theory.

Similar to what has been pointed out in distraction theory, the effect of self-focused attention may not always be devastating to performance. Beilock et al. (2002) suggested attention to step-by-step execution process for experts may be unpalatable because it dechunkes and changes proceduralized skills. This immediate effect might have been judged to be unproductive by the skilled performer. In the long haul, however, it may be beneficial because skill execution has been adapted to satisfy desired outcomes. In particular, such a self-focused attention to execution is best to occur during practice rather than matches where the optimal performance is the desired outcome.

### **Relationship between Distraction Theory and Explicit Monitoring Theory**

The relationship between distraction theory and explicit monitoring theory can be possibly illustrated by the relationship of possible mechanism models underlying each of them. Baumeister and Showers (1986) offered five models to explain why self-focused attention impairs performance. The first model puts forward the notion that athletes hold the expectation that reward follows good performance (Haddad, McCullers, & Moran, 1976; McGraw &

McCullers, 1974; Miller & Esters, 1961, as cited in Baumeister & Showers, 1986). This expectation leads to choking by having athletes imagine that they win the competition prize. The second model is about worry. Specifically, the performer chokes by concerning the potential cost of his/her failure in the sport. The third explanation pertains to the point that attention to oneself is a distraction. It is because, according to some researchers (Duval & Wicklund, 1972; Wicklund, 1979, as cited in Baumeister & Showers, 1986), attention to oneself is exclusive to that paid upon things other than oneself. The last two models suggest that one either execute the skill consciously or automatically. In situations when one draws attention to oneself, the skill would be executed consciously. One model proposes that the automatic way of skill execution is better than the conscious way because the latter does not include certain requisite information of how to properly execute the skill. Therefore, conscious skill execution would disrupt performance by interfering with the already proceduralized process (Baumeister, 1984). The alternative model expounds that consciousness does have all the information regarding proper skill execution. However, choking occurs because consciousness is aware of alternative responses and more time would be cost in choosing the optimal response (Carver & Scheier, 1981, as cited in Baumeister & Showers, 1986). Upon consideration, the first three models mentioned above are essentially using distraction to explain the detrimental effect of self-focus towards performance. The last two models, however, exhibit a distinct mechanism from distraction. More concerned with the last two models, Beilock et al. (2004) suggested such a distinction may implicate “a skill taxonomy based on real-time control structures” (p. 584) and hence intimated the implications of theory of skill acquisition to attentional theories of choking.

**Theory of skill acquisition.** Theories of skill acquisition (Anderson, 1982, 1983; Fitts & Posner, 1967) suggest that athletes’ level of sport expertise dictates what they should focus on

when performing a complicated athletic skill. For novices (who are at the cognitive/declarative stage of performance), athletes' attention should be paid to each element of the execution process. In this stage, skill execution is assumed to take a step-by-step form that requires the attendance of working memory. All these requirements inevitably lead novice players to execute the skill in a slow, non-proceduralized, inconsistent fashion. For experts (who are at the autonomous/procedural stage), they are supposed to pay no attention to the step-by-step components of the execution process. They can perform in such a fast, efficient way that no assistance of working memory is needed. Therefore, different attentional mechanisms engaged by novices and experts seem to be a key difference in their skills execution process.

Theory of skill acquisition has received support from research. In Experiment 2, Beilock et al. (2004) had both novice and expert golfers putt under two conditions. The first condition emphasized accuracy and golfers were led to be as accurate as possible in their putts. The second condition emphasized speed and golfers were required to putt as fast as possible with an upper limit of 3 seconds. It is assumed that participants under speed condition would not have enough time to putt while paying attention to execution steps. Results showed that novice were better in the accuracy condition (compare to themselves in speed condition), and an opposite pattern were observed for the experts. This experiment supports theory of skill acquisition because novice putted better in the condition encouraging conscious attendance to their skill execution whereas expert had better performance in the condition that limit, instead of encouraging, attention to execution process.

In another study, Beilock et al. (2002) designed two experiments to substantiate the differences between novices and experts predicted by the theory of skill acquisition. In Experiment 1, experienced golfers (experts) were instructed to putt in two conditions: the dual-

task condition (to distract golfers from the main putting task) and the skill-focused conditions (to prompt golfers' attendance to steps of putting). Results indicated that the expert golfers putted better in the dual task condition. This experiment can be regarded as a direct evidence of theory of skill acquisition. In Experiment 2, Beilock et al. changed the participants to right-foot novice and expert soccer players. They dribbled a ball through a slalom course also under the same two conditions in Experiment 1. Results showed that when using subdominant (left) foot, experts had better performance following the skill-focused requirement (than themselves following the dual-task requirement). Novices performed better under skill-focus condition (than themselves under the dual-task condition) no matter which foot they engaged. Whereas novices and experts with subdominant foot benefit from attentionally monitoring their skill execution, the performance of expert with dominant foot is harmed. This experiment seems to develop the theory of skill acquisition further by raising the prospect that "attentional focus can have differential effects within an individual performer" (Gray, 2004, p. 43). Actually, Nideffer (1978) had already brought up the importance of attentional focus to performance years ago. In his view, attention focus is the most dominant factor in affecting performance and he proposed the attentional style model (Nideffer, 1976).

**Attentional style.** Psychologists have put serious considerations on attention for a long time because of its utility in behavior interpretation and prediction. To explain inverted U hypothesis regarding drive and performance, Easterbrook (1959) conceptualized cue utilization theory which has two attentional dimensions. The first one is the width of attention and the second is task-relevancy of attentional cues. However, this theory was largely grounded in the drive theory and the second dimension seems to show difficulty in its definition and measurement. The attentional style model is an alternative model to study the relationship

between attention and performance. Nideffer (1976) advocated that the concept of attentional style consists of two dimensions. Width of attentional focus is the first dimension and it can range from narrow (i.e., visually fixate upon just a few things) to broad (i.e., visually fixate upon a number of things) (Cromwell, 1968; Easterbrook, 1959; Wachtel, 1967), which is identical to Easterbrook's cue utilization theory. Yet, the second dimension of attentional style is defined as the direction of one's attentional focus. Specifically, one can concentrate on his or her internal conditions (e.g., thoughts, feelings) or on external things (e.g., events taking place around the athlete) (Heilbrun, 1972; Shakow, 1962). Consequently, four combinations of attentional style dimensions are generated: broad-internal, broad-external, narrow-internal, and narrow-external. A good example of attentional style can be demonstrated by a midfielder in soccer games. When this soccer player dribbles the ball up for attack, he or she would search the field both for teammates and opponents. In this situation, a broad-external attentional focus is recommended. However, as soon as a recipient of the pass is decided, a sharp shift to a narrow-external focus would be most ideal. With respect to the theory of skill acquisition, it is very likely that as an athlete becomes more and more skilled through practice, the best attentional style on the dimension of direction gradually shifts from the inside to the outside. In contrast, the width dimension relies heavily on the non-personnel factors (such as the type of sports, the specific situation within one sort of sport). Therefore, distraction theory (Baumeister & Showers, 1986) and explicit monitoring theory (Beilock & Carr, 2001; Lewis & Linder, 1997; Masters, 1992) may well explain two separate facets of the truth, whereas one's attention style plays a central role in this process. But one pervasive weakness of the attentional theories of choking is that their explanations of the "black box" are superficial, and a more profound exploration will

undoubtedly further the understanding and offer better interventions of choking under pressure. In this light, the ironic processing theory (Wegner, 1994) seems to be an applicable avenue.

### **Theory of Ironic Process of Mental Control**

Wegner (1994) recognized there has to be at least two processes to control a system in order to maintain checks and balances. One memory process must be in charge of producing the correcting output, and the other is responsible for evaluation of the first process. This is because an identical system cannot manage to launch something (thoughts or actions) towards a criterion (or goal) while making evaluations of itself to reduce the discrepancy. Humans are likely to fall prey to the ironic processes because the two processes tend to compete with each other in order to reach the goal state.

Wegner (1994; 1997) named the two ongoing systems as *operating process* and *monitoring process*, respectively. In Wegner (1997) view, the operating process is “conscious, effortful, and interruptible and perform the ‘work’ of mental control”; in contrast, the monitoring process is “unconscious, less effortful, but uninterruptible as long as mental control is exerted” (p. 12). The existence of the monitoring process has been supported by analysis of human event-related brain potentials (ERPs) relating to mistakes (Gehring, Coles, & Meyer, 1990). The monitoring process is unique in that its unconscious operation can also lead to errors. That is, it is an active unconscious search instead of being passive (Wegner, 2009). When mental load interferes with the operating process, the unchecked monitoring system can sensitize one to the exactly counter-will results.

For example, Dugdale and Eklund (2003) conducted a study having full-time female dance students perform a static balance task. The students performed the task by standing on a wobble board (i.e., a balance-training rehabilitation equipment for ankle and knee injuries). It

produces an indicator of one's balance performance. Cognitive load (i.e., high vs. low) and attentional focus (i.e., "hold steady" vs. "don't wobble") were incorporated as two factors in their within-participant design. More specifically, cognitive load was manipulated by asking dancers to count backward mentally from 1000 by 7s and the attentional focus to verbally rehearse the given cue words immediately before the start of each trial. The result supported the ironic processing theory and the participants performed significantly worse when they were under high mental load or following the "don't wobble" instruction. However, Dugdale and Eklund did not find an interaction effect between mental load and attentional focus, probably because of the small sample size ( $N = 16$ ). Other limitations of this research include restricted generalizability by involving merely female participants and employing mental load that is not typical in sports setting.

### **Mental Load**

Even though mental load was conceptualized to enhance ironic processes, this role of mental load has been questioned. In one study, Beilock et al. (2001) had participants perform golf putting task after using three different types of imagery (suppressive imagery, positive imagery, and suppression-replacement imagery) under two sorts of frequency (i.e., before each putt and before every third putt). Apart from most studies examining ironic processing theory of mental control, their study did not manipulate mental load. Two studies (Macrae, Bodenhausen, Milne, & Jetten, 1994; Wegner, Schneider, Carter, & White, 1987) were cited as support for their hypothesis. That is, the occurrence of to-be-suppressed imagery (i.e., the ball rolled past the target or the ball stopped short of the target) can be facilitated even without depleting one's attention resource. The result did not support the hypothesis. To note, in Wegner et al. (1987)'s research, their suppressive thought instruction was to have the participants try to suppress the

thought of a white bear and participants reported more awareness of the white bear as a consequence. Beilock et al. (2001)'s study departed from Wegner et al. (1987)'s study in that Beilock et al.'s to-be-suppressed imagery has an apparent opposite (e.g., the opposite of the ball rolling past the target is to have the ball stop short of the target) while Wegner et al.'s to-be-suppressed thought (the white bear) does not (e.g., the opposite of the white bear is a black bear, a duck or a mouse?). This is supported by Beilock et al.'s result that participants overcompensated the to-be-suppressed imagery by putting the ball past the target while suppressing "short" imagery and by putting the ball short of the target while suppressing "past" imagery. In the other study claimed as support for Beilock et al. (2001)'s mental-load-not-necessary hypothesis, Macrae et al. (1994) studied the effect of stereotype suppression on one's stereotype awareness. Although they did not employ mental load in their study, there were quite a few limitations which wrecked their support for the appropriateness of Beilock et al. (2001)'s research design: (a) no direct measurement of to-be-suppressed stereotyped thoughts (i.e., participants' sitting distance to the cloth being told as belonging to the person in stereotype and participants' reaction time to stereotyped words were regarded as the indication of stereotype thoughts); (b) the stereotype-thought suppression process and the measured process of stereotype thought occurrence were not concurrent in time, and therefore failed to meet the concurrency requirement of the two processes in ironic processing theory of mental control; (c) the instruction of stereotype-thought suppression might itself be a mental load for participants. In a nutshell, the existence of mental load is perhaps still crucial for eliciting thought rebound effect, even though cases of seeming exemption have been reported.

In the literature, several forms of mental load have been employed in investigations of theory of ironic process of mental control, such as memory load (keeping in mind a word list or



digit string) and arithmetic calculation (e.g., counting backward from 1000 by 3s) (Wegner et al., 1998). Furthermore, Wegner (1994) hinted that other forms of mental load, including internal and external distractions, time constraints, emotional loading (anger, anxiety, depression), and alcohol intake can also add more probability to the occurrence of ironic processes. Different loads may exercise varying influence upon the size of ironic effect, but the theory postulates that negative emotional loads should allow for a greater degree due to its function of both the operating process deterioration and load-inducing nature (Janelle, 1999).

As for the management of mental loads, it can be achieved either by managing stress or narrowing down the strategic and decision-making components (e.g., cutting down the degree of freedom in motor learning) of performance. Moreover, mental loads can also be brought down by familiarizing oneself with the competitive situations (Janelle, 1999).

A surprising research finding is that sometimes even physical loads are able to elicit ironic effects in movement. In an experiment, Wegner et al. (1998) asked participants to hold a brick in one outstretched arm while holding a pendulum in the other arm. The results showed that such a physical load had equivalent effect on the movement of pendulum as its mental counterparts (counting backward from 1000 by 3s).

To sum up, mental load should be used with caution in examining theory of ironic effect of mental control and it can take numerous forms. In particular, some forms of mental load are typical elements in sports setting and therefore support the theory's applicability to sports phenomenon, such as choking under pressure.

### **Ironic Processing Theory of Mental Control and Choking under Pressure**

There are several possible connections between some of the postulations derived from theory of ironic process of mental control and choking under pressure. The first connection

comes from the ironic effect resistance methods. Wegner (1994) suggested three ways to resist ironic effect, “That is, avoidance of mental load and care in the deployment of mental control intentions.... There is one other path to resistance, however, that is worth considering: the automatization of the operating process” (p. 48). The last method is of interest here. The proceduralized movements can help skilled athletes avoid regarding their action execution process as somehow a mental load and hence help athletes develop the resistance to ironic effect. However, when athletes have been influenced to make their already automatized skills into intentional ones or conscious ones, they would be deprived of such an advantage and fall prey to the ironic processes of mental control.

Self-loading system (Wegner, 1994) is another part of the ironic process theory possible to be linked to choking. This system operates like a vicious circle, during which a former ironic event can be considered as a mental load resource for the next one. Wegner et al. (1997) have demonstrated that the cycle of failed attempts at relaxation can lead people to develop what has been called fear of fear or anxiety sensitivity. In sports setting, this self-loading system may be a resource of choking (probably like what happened to Mr. Emmons). However, ironic results will not occur if one does not bring relevant themes into attentional focus. In such a situation, self-talk can be a handy tool in shifting one’s attentional focus.

### **Self-Talk**

“The common use of self-talk in combination with other mental skills (i.e. the use of mental skills packages) does not, however, permit an understanding of how each of the respective aspects function in a stand-alone fashion” (Hardy, 2006, p. 81). Self-talk has been one such under-investigated area within sports psychology that it has been defined in various ways with different emphasis. These definitions range from combining cognitive elements with

behavioral elements to the more commonly cognitive oriented framework (Hardy, 2006).

Therefore, a clear definition would be the first step to understand self-talk.

Hardy (2006) has given a working definition of self-talk in the following aspects: “(a) verbalizations or statements addressed to the self; (b) multidimensional in nature; (c) having interpretive elements association with the content of statements employed; (d) is somewhat dynamic; and (e) serving at least two functions; instructional and motivational, for the athlete” (p. 84).

Landin (1994) and Nideffer (1976) interpreted the role of self-talk as having an attention underpinnings. Landin upheld the point that one can use self-talk to enhance one’s attentional focus, and Nideffer thought it can be treated as an effective technique of directing and redirecting attention resources to the most proper attentional style.

Self-talk may also seem to have the potential of leading to ironic effect by directing one’s attention to concerned issues. In one study, O’Brien Cousins and Gillis (2005) used random telephone surveys to assess 40 adults’ weekly physical activity and plans of exercise. The sample was stratified for gender, age and geographic location. An unexpected finding in the study was that self-talk was not regarded beneficial for exercise activity maintenance by the “real exercisers”. That is, self-talk failed to enhance participation of physical activity. These active people would like to set physical activity into their daily routine and “Just do it”. This is because they are concerned about rethinking their physical plan and talking themselves out of it. This may well explain why these people nail their physical activity into a daily routine no matter what the threatening factors are (e.g., bad weather, muscle soreness, and lack of companionship).

## **The Present Study**

### **Purpose of the Study**

In the present study, I tested whether choking under pressure could be predicted by postulations of the theory of ironic process of mental control, while employing self-talk to direct attentional focus. Participants of the study were required to perform a hand motion steadiness task. In sports setting, the quality of athletic performance is decided by measuring the refinement and precision of physical movements. A consistent ability to produce accurate movements usually leads to optimal performance (Janelle, 1999). In particular, many sports types, such as 50m rifle three positions, skeet shooting, and archery, involve stringent demands of athletes' hand motion steadiness in order to excel.

Two factors were manipulated in the study: Pressure, and Attentional Focus. Participants' pressure was elicited by an informed time constraint (which was a fake). Participants' attentional focus was manipulated by being engaged in explicit self-talk for 10 s right before their task. This prescription of self-talk had been successfully employed in a previous research (Dugdale & Eklund, 2003) relevant to ironic processing theory. To test effectiveness of these manipulations, post-experiment-survey ratings were obtained.

It was hypothesized that there would be no gender difference in performing the task. In addition, the effect of pressure and attentional focus on task performance would be examined, respectively. In light of Dugdale and Eklund (2003)'s study which also included within-participant trials, it is hypothesized that there would be no within-participant main effect for trials in the current study. The most important interest of current study was to test whether task performance of the group under high pressure with suppressive self-talk deteriorated compared with that of the other groups. Finally, skin conductance level (SCL) as a controversial measure of

pressure level would be examined by comparing it to the pressure ratings in the post-experiment survey.

## **Hypotheses**

- (1) No task-performing difference would emerge across trials within the participants.
- (2) There would be no gender difference in task performance.
- (3) Performance under high pressure would be worse than performance without pressure.
- (4) Performance with suppressive self-talk would be worse than performance with task-focused self-talk.
- (5) Performance of the group doing thought-suppression self-talk under high pressure (i.e., HPSS) would be worse than the other three conditions (i.e., HPFS, LPSS, and LPFS).
- (6) SCL would generate the same results as pressure ratings in measuring the pressure level.

## CHAPTER 3

### METHODS

#### **Participants**

An a priori power analysis was performed using the software G\*Power 3.1.3 with repeated measurement ANOVA (RM ANOVA). It showed that the current study would have a statistical power of .968 to detect a significant difference when other relevant parameters of the research design are input into G\*Power. These relevant parameters included effect size  $f$  (0.25), alpha level (.05), total sample size (80), number of groups (4), number of measurement (2), correlation among repeated measures (0.5), and nonsphericity correction (1). Florida State University undergraduates (62 males and 59 females, all aged over 18) from the College of Education (COE) participant pool were tested for the study. This experimental participation was to meet the requirement of their courses and gained them one credit after participation. Besides, three of the participants each received a \$10 Starbucks gift card in a way of lottery. In order to perform the designated task, all the participants presented evidence of no disability or deformity of vision and upper limbs. Among these participants, 22 males and 19 females did not meet the attentional focus inclusion criteria in the post-experiment survey and thus their data were dropped from the analyses for testing the hypotheses. For the remaining 80 participants (40 males and 40 females, and  $M_{age} = 20.62$ ,  $SD_{age} = 1.78$ ), all responded with five or higher on the question “To what extent did you pay attention to the instruction of explicit self-talk while performing the task” ( $M_{rating} = 5.6$ ,  $SD_{rating} = .661$ ). Among these participants, 10% indicated that they are left-handed and 90% of them are right-handed ( $n_{left} = 8$ , and  $n_{right} = 72$ ). Their data were analyzed to test the hypotheses of the study..

## **Study Design**

The study consisted of four between-participant factors (i.e., Gender, Pressure, Attention, Order) and one within-participant factor (i.e., Phase). After the obtainment of informed consent, a gender stratified random assignment was employed to assure a 2 (high pressure vs. low pressure)  $\times$  2 (task-focused self-talk vs. suppressive self-talk) experimental design. Thus, four groups were identified, including high pressure suppressive self-talk (HPSS), high pressure task-focus self-talk (HPFS), low pressure suppressive self-talk (LPSS), and low pressure task-focus self-talk (LPFS). For participants within each group, they performed two blocks (i.e., baseline and test) of 10 trials and their performance accuracy (i.e., width of path) and duration of each trial was measured. To control the learning effect, a counterbalanced design was used within each group. In other words, for participants within one group, half of them performed baseline block first followed by the test block, and the other half finished test block before baseline block.. A non-interested between-participant factor Order indexed this counterbalance process. It was included in the analysis to enhance the power of statistical test and check its effect on the performance. The design of the research is illustrated in Figure 1.

## **Task Manipulation**

To manipulate pressure, a fake time constraint was used due to its high ecological validity in many sport endeavors. Participants in the low pressure group were told that there was no time limit in the task and they were supposed to try their best to perform the task. In contrast, participants in the high pressure group were told that there was a time constraint of 9 s for their task (when there were actually no actions taken when they went beyond nine seconds in their performance). In addition, they were also informed that their adherence to the time constraints would be connected to their chance of getting a Starbucks gift card because the researcher would

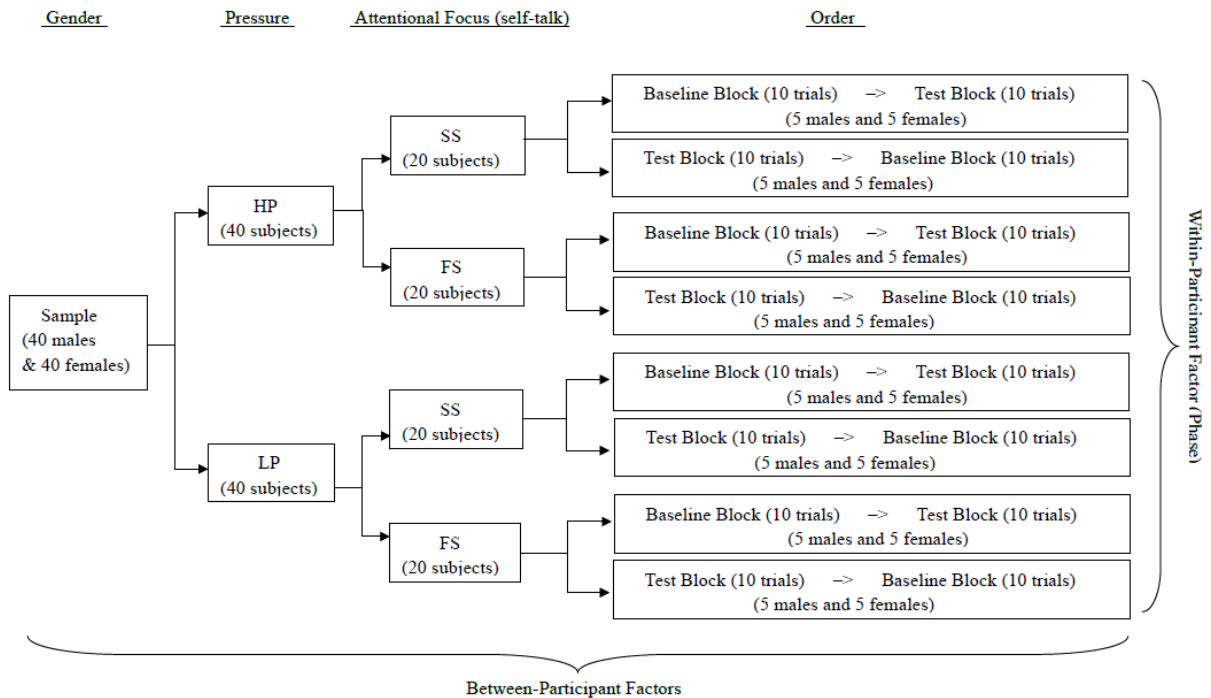


Figure 1. Study design

take notes on how many times they violate this rule. The time constraint was manipulated in this way based on the findings of pilot testing. The pilot testing also indicated that the 9 s period would be shorter than the usual performance duration for most participants on the hand motion steadiness task and hence it posed a challenge to participants' performance duration. The gift cards mainly played a role of extrinsic reward. It was expected to strengthen the effect of time constraint instruction. Self-talk was employed to control participants' attentional focus. Half of the participants were instructed to repeat out loud the cue words "Don't Shake" during the 10 s before they started to perform, whereas the other half of participants were instructed to use the phrase "Go Steady" during the 10 s preceding the task initiation. All the participants were required to "try to hear the cue words" after they started to perform the hand motion steadiness task.



## **Instruments**

### **Informed Consent Form**

The consent form (Appendix A) served as a description of current study's task requirement and procedure, risks and benefits of involvement, confidentiality, and so on. However, a minor deception of omission was involved in identifying the research purpose in the consent form so that participants' performance would not be confounded by their awareness of the investigative purpose.

### **Demographic Form**

Demographic details such as gender, age, visual condition and physical disability, as well as the dominant hand, were collected by a demographic questionnaire (Appendix B). Participants were asked to fill out the demographic form after they agreed to participate into the study and sign the informed consent form.

### **Motion Steadiness Test Apparatus**

An apparatus (see Figure 2) was used to measure how steady the movement of one's dominant hand could be. This device has three ways (i.e., curvilinear track, linear wedge track, and holes) to measure one's hand motion steadiness. In the present study, participants were asked to perform in the curvilinear track (which is symmetric) with a stylus wired up to the main device box. The start-off point of the motion steadiness task is the mid-point of the curvilinear track, which is 10 mm wide. Both ends of the curve own a width of 2 mm and the narrowing transition is gradual from the start to the two ends. The diameter of the stylus tip is 1.5 mm. If the stylus touches the bottom of the track, the red light at the up-center will light up as a warning sign.

When the stylus touches the side of the curvilinear track, a beeping sound will be made and the reading of the path's width at that point can be read referring to the scale on sides of the track.



*Figure 2.* Apparatus for hand motion steadiness measurement

### **Skin Conductance Level (SCL) Device**

This device consists of two skin conductance sensors (see Figure 3) connected to a laptop (to generate and record the readings of the sensor) via a coder box. SCL has been used as a biofeedback indicator of one's anxiety level by some researchers (Fortier, Martin, Chorney, Mayes, & Kain, 2011; Fowles et al., 1981; Wegner et al., 1997; Wegner et al., 1993). This function of SCL is built upon the assumption that there is a positive relationship between SCL and one's anxiety level. However, El-Sheikh, Keiley, and Hinnant (2010) have suggested that SCL readings are “markers of the activity of the sympathetic nervous system (SNS)” (p. 116) and its main function is to facilitate the “fight or flight” behavior in stressful situations. In this light, other researchers believe that SCL is merely a measure of activation-arousal level instead

of perceived pressure level, or anxiety level (Salazar et al., 1990; Tremayne & Barry, 2001). According to Lazarus (2000), one's anxiety level differs from activation-arousal level in that it has cognitive components in addition to physiological response. Bewaring of this moot issue, a secondary endeavor of the present study is to further explore the role of SCL in measuring the construct of perceived pressure.



*Figure 3.* Skin conductance sensor

### **Video Camera and Tripod**

A video camera (Canon VIXIA HFM40) and a tripod were involved in the present study to record participants' hand-motion task performance. Participants were informed of their presence and purpose before they started the task. All the recordings were automatically formed into MTS documents by the video camera and the researcher read the scores of all the participants from these documents after the experiment.

## **Stopwatch**

A stopwatch was employed for two purposes in the current study. First, the researcher used it to count the 10 s for participants doing explicit self-talk right before they started to perform the task. Second, participants' performance duration of each trial was also recorded by the stopwatch.

## **Post-Experiment-Survey Items**

The survey questions were adapted from former investigations (i.e., Theodorakis, Weinberg, Natsis, Douma, & Kazakas, 2000; Wegner et al., 1997). It consists of three 7-point Likert-type questions (Appendix C). The first question is "To what extent did you pay attention to the instruction of explicit self-talk while performing the task" and it is a manipulation check for participants' attentional focus (directed by self-talk). The attentional focus manipulation was only considered as effective for participants whose ratings are equal to or over five on this question based on former research result (cf. Vuillerme & Nafati, 2007). The second and third questions asked participants' to rate on how much pressure they felt during their performance. The only difference between these two questions was that the second question was for the baseline block and the third question the test block. Different from the objective approach of SCL, these questions tapped participants' subjective feeling of their pressure level and they were used as the manipulation check for participants' pressure perception.

## **Procedures**

All the participants were recruited from the COE participant pool of FSU and they registered to join the experiment through an online system. The researcher scheduled specific time slots with these participants and the study was conducted in the Sports Psychology Lab located at Stone Building of FSU main campus.

When participants arrived at the experiment room, they were instructed according to a pre-prepared script (Appendix D). Participants were invited to read and sign a consent form. If they agreed to participate, they were asked for their demographic information. They were told that this study is about the relationship between skin conductivity and hand motion steadiness, and their goal in the task was to do their best in the steadiness test. Then, about five min were spent on attaching the SCL sensors on the second phalanges of index and middle fingers of the participants' subdominant hand (Caterini et al., 1995) and having participants practice 10 trials of the main task using their dominant hand. The practice was to give participants a warm-up and the participants had to choose one direction (i.e., either go left or go right) of the symmetric curvilinear track in their formal test. Once chosen, the direction of task cannot be altered during the formal test.

Each participant was randomly assigned (with gender being stratified) to one of the four groups (i.e., HPSS, HPFS, LPSS, and LPFS) of the study with counterbalanced control of the order of blocks. Each participant then was asked to complete two blocks of 10 trials of the task (with a 30 s rest period between two consecutive trials and 5 min between the blocks). One of the two blocks was regarded as a baseline block and the learning effect was controlled by the counterbalanced design. In the baseline block, there was no manipulation exerted upon participants. However, relevant manipulations would be addressed to participants in the other block of task trials. Participants' performance of both blocks was videotaped by using the camera and tripod. The task began only after participants fully grasped the meaning of the instruction by telling researcher the goal of their task (with or without time constraint) and the explicit self-talk cue words.

Immediately after the task, each participant was asked to fill out the post-experimental survey form, and the SCL electrodes were detached from participants as well during this period. On the completion of the survey, participants were asked to leave their email address and then dismissed. The debriefing script (Appendix E) of the study was emailed to them at the end of data collection. They were offered a chance to ask questions back and decide whether their data could be used for the current research.

### **Analyses**

The study used the software SPSS 18.0 for the following statistical analysis. First, descriptive statistics such as group mean and standard deviation were reported for each variable. Second, manipulation check of perceived pressure level was performed by testing pressure ratings in RM ANOVA. Thirdly, a second RM ANOVA was performed to check whether there was performance difference cross trials within participants. Then, Pressure, Attention, Gender, and Order were input as between-participant factors. The two width medians from the baseline and test block, respectively, were input as the within-participant factor (i.e., Phase). An RM ANOVA figuring these factors was performed to test the main hypotheses of the present study. Lastly, another RM ANOVA was performed (in a same way as pressure ratings) to test SCL as a measure of one's pressure level.

## CHAPTER 4

### RESULTS

#### **Descriptive Statistics**

The median performance score (i.e., width median) of the hand motion steadiness task for each block was used as the representative value for that particular block. That is, the median of width scores from the baseline block was treated as the performance of participants when no manipulations were addressed to them and so was the median of width scores from the test block when relevant manipulations were added upon participants. Median was chosen to avoid the influence of extreme values from each participant's performance distribution. Extreme values are often spotted in individual's performance distribution and they appeared more on the side that has larger width values (i.e., participants touch the side of the path near the start point, which is supposed to be easy to pass) than the other side with smaller width values (i.e., participants go much further along the path beyond the point they usually touch).

The values of width median (of each block), task-completion time, SCL, pressure rating, and attentional focus rating were calculated. Group means and standard deviations by Gender, Attention (self-talk), Pressure at baseline and after manipulation are shown in Table 1.

#### **Manipulation Check**

Because only participants who rated equal or over five on the "attentional focus" question were included in the study, the manipulation on participants' attentional focus was considered successful. A RM ANOVA was performed to check the pressure manipulation by using pressure ratings (from the post-experiment survey) as the dependent variable. Four between-participant factors (i.e., Gender, Pressure, Attention, and Order) and one with-participant factor

Table 1

Means and SDs (in brackets) of width median, time, SCL, pressure ratings and attentional focus rating at baseline and after manipulation

		LPFS		HPFS		LPSS		HPSS	
		Male	Female	Male	Female	Male	Female	Male	Female
Width	Base.	4.79	4.07	4.78	4.61	3.78	4.58	4.53	4.46
		(.550)	(1.264)	(.749)	(.528)	(.842)	(.578)	(.791)	(.650)
Median	Test	4.60	3.79	5.29	4.68	4.48	4.48	5.08	4.63
		(.438)	(.983)	(.791)	(.687)	(1.002)	(.644)	(1.166)	(.935)
Time	Base.	10.17	13.13	6.29	8.57	10.17	9.26	8.86	11.18
		(2.52)	(3.95)	(2.18)	(4.14)	(2.52)	(5.12)	(4.19)	(5.12)
SCL	Test	11.21	16.19	4.31	5.12	11.21	9.03	5.56	6.69
		(2.75)	(6.63)	(1.20)	(1.66)	(2.75)	(6.22)	(3.09)	(1.29)
Pressure	Base.	1.957	1.607	2.608	1.771	1.957	2.909	5.428	3.324
		(1.541)	(1.188)	(1.180)	(1.095)	(1.541)	(2.571)	(6.035)	(2.130)
Rating	Test	2.354	1.813	3.099	2.159	2.354	2.906	5.592	3.484
		(2.389)	(1.571)	(1.201)	(1.268)	(2.389)	(2.399)	(5.136)	(2.152)
Attention	Base.	2.9	3.0	2.7	3.0	2.9	4.4	3.4	3.2
		(1.18)	(1.16)	(1.77)	(1.41)	(1.20)	(1.27)	(1.27)	(1.32)
Attention	Test	3.7	3.6	4.2	4.1	3.7	4.2	4.3	3.9
		(1.83)	(1.27)	(1.75)	(1.91)	(1.83)	(1.93)	(1.25)	(1.52)
Attention	Base.	5.8	5.7	5.7	5.7	5.7	5.5	5.5	5.5
		(.92)	(.82)	(.68)	(.68)	(.68)	(.53)	(.53)	(.53)



(i.e., Phase) were included in the model.

Regarding the results, there was a significant main effect of Phase,  $F(1, 71) = 15.609$ ,  $p < .001$ ,  $\eta_p^2 = .180$ , and a significant interaction between Phase and Pressure,  $F(1, 71) = 5.625$ ,  $p = .031$ ,  $\eta_p^2 = .064$ . However, the main effect of Phase did not merit further analysis in the presence of a significant interaction between Phase and Pressure. The interaction between Phase and Pressure was displayed in Figure 4. This result illustrated that participants assigned to high pressure group not only had stronger pressure perceptions in test block than did themselves in the baseline block, they also perceived stronger pressure feelings in the test block than did those assigned to low pressure group in the test condition. In short, the results of pressure ratings supported the success of pressure level manipulation.

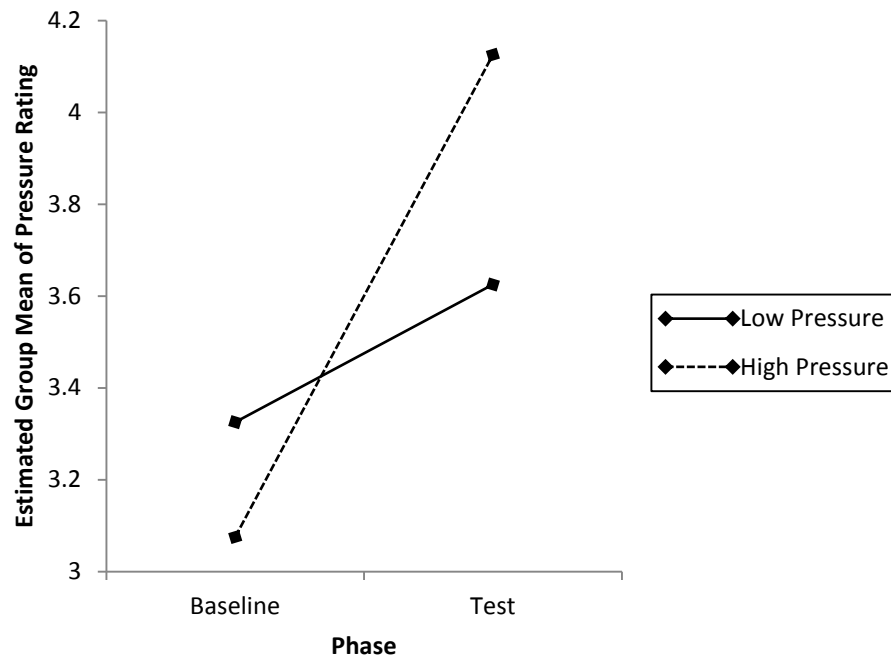


Figure 4. Means of pressure ratings by Pressure and Phase

### **Within-Participant Performing Difference across Trials**

The within-participant performance difference across trials test was for the first hypothesis. RM ANOVA was employed for this test, where the 10 trials of the baseline and test block were input as the within-participant variable, respectively, and Gender, Attention, and Pressure were input as the between-participant factor. For the 10 trials of the baseline block, Mauchly's test of sphericity was not significant, Mauchly's  $W = .431$ , approximate  $\chi^2 (44) = 57.975$ ,  $p = .078$ , and there was a nonsignificant within-participant effect across baseline trials for all participants,  $F (9) = .747$ ,  $p = .666$ ,  $\eta_p^2 = .010$ . For the 10 trials of the test block, Mauchly's test of sphericity was significant, Mauchly's  $W = .342$ , approximate  $\chi^2 (44) = 73.844$ ,  $p = .003$ , and therefore Greenhouse-Geisser test for within-participant effect was chosen and there was not a significant within-participant effect across test trials for all participants,  $F (9) = 1.876$ ,  $p = .068$ ,  $\eta_p^2 = .025$ . In short, the first hypothesis was supported that there were no within-participant performance difference across trials, no matter it was the baseline block or the test block.

### **Group Difference**

According to the design of the study, a Gender (Male vs. Female)  $\times$  Attention (Suppressive Self-Talk vs. Task-Focused Self-Talk)  $\times$  Pressure (High Pressure vs. Low Pressure)  $\times$  Order (Baseline, Test vs. Test, Baseline)  $\times$  Phase (Baseline vs. Test) RM ANOVA was performed. The first four variables are between-participant factors and Phase is a within-participant factor. The results of the RM ANOVA were listed in Table 2.

Table 2

RM ANOVA for width median by Gender, Pressure, Attention (Self-Talk), Order and Phase

Source	$F(1, 71)$	$p$	Partial $\eta^2$
<i>Within-participant effect</i>			
Phase	6.192	.015	.080
Phase $\times$ Order	3.321	.073	.045
Phase $\times$ Gender	8.667	.004	.109
Phase $\times$ Pressure	4.204	.044	.056
Phase $\times$ Attention	4.496	.037	.060
Phase $\times$ Pressure $\times$ Attention	2.599	.111	.035
Phase $\times$ Gender $\times$ Pressure	.015	.903	.000
Phase $\times$ Gender $\times$ Attention	1.297	.259	.018
Phase $\times$ Gender $\times$ Pressure $\times$ Attention	1.868	.176	.026
<i>Between-participant effect</i>			
Order	.238	.627	.003
Gender	2.273	.136	.031
Pressure	6.654	.012	.086
Attention	.190	.664	.003
Gender $\times$ Pressure	.177	.675	.002
Gender $\times$ Attention	3.664	.060	.049
Pressure $\times$ Attention	.283	.596	.004
Gender $\times$ Pressure $\times$ Attention	2.318	.132	.032

The within-participant main effect of Phase,  $F(1, 71) = 6.192, p = .015, \eta_p^2 = .080$ , and the between-participant main effect of Pressure,  $F(1, 71) = 6.654, p = .012, \eta_p^2 = .086$  are significant. However, as there were other significant interactions involving factor Phase and Pressure, these significant main effects were not of interest in the present study.

The second hypothesis was that there would be no gender difference in the hand motion task performance. However, this hypothesis was not supported by the analysis. RM ANOVA indicated that the within-participant effect of Phase  $\times$  Gender interaction reached significance,  $F(1, 71) = 8.667, p = .004, \eta_p^2 = .109$ , pre-post Cohen's  $d = .45$ . Even though male and female participants have similar performance score for the baseline block ( $M_{\text{Male}} = 4.47, M_{\text{Female}} = 4.425$ ), they showed a significant difference in performing the hand motion steadiness task for the test block under varying manipulations (see Figure 5). Specifically, female participants had a steady performance ( $M_{\text{Female}} = 4.393$ ), whereas the male participants performed worse ( $M_{\text{Male}} = 4.858$ ).

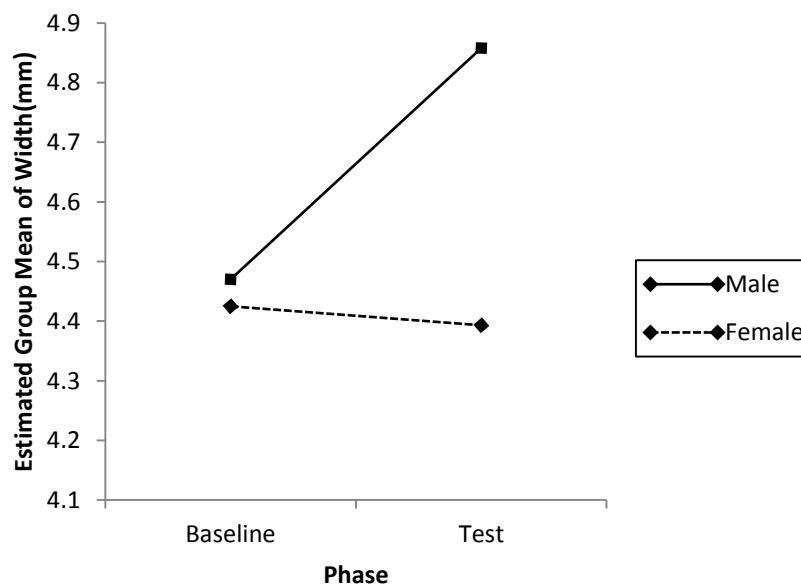


Figure 5. Means of width median by Phase and Gender

The third hypothesis stated that performance under high pressure would be worse than performance under low pressure. This hypothesis was supported by the result that there was a significant within-participant effect of Phase  $\times$  Pressure interaction,  $F(1, 71) = 4.204, p = .044, \eta_p^2 = .056$ , pre-post Cohen's  $d = .27$ . For the low pressure group, participants' performance for the baseline and test block remained similar ( $M_{\text{Baseline}} = 4.303, M_{\text{Test}} = 4.334$ ). In contrast, participants from the high pressure group performed worse in their test block ( $M_{\text{Test}} = 4.916$ ) than in their baseline block ( $M_{\text{Baseline}} = 4.592$ ). The result was shown in Figure 6.

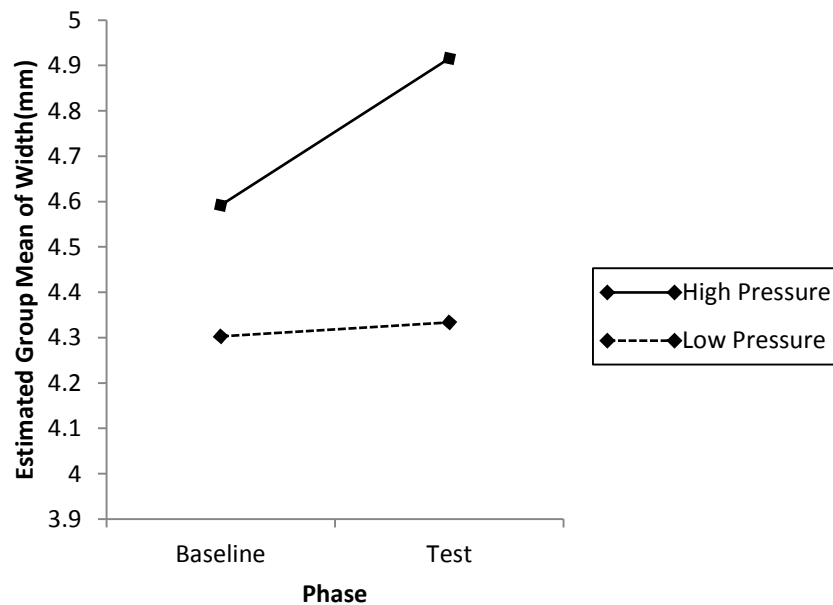


Figure 6. Means of width median by Phase and Pressure

The fourth hypothesis predicted that performance with suppressive self-talk would be worse than performance with task-focused self-talk. This hypothesis was supported by RM ANOVA that there was a significant within-participant effect of Phase  $\times$  Attention interaction,  $F(1, 71) = 4.496, p = .037, \eta_p^2 = .060$ , pre-post Cohen's  $d = .36$ . For the group doing task-focused self-talk, participants' performance of test block ( $M_{\text{Test}} = 4.586$ ) was similar to that of

baseline block ( $M_{\text{Baseline}} = 4.56$ ). However, a performance difference was observed (see Figure 7) between the two blocks for participants doing suppressive self-talk. In greater detail, their performance deteriorated in the test block ( $M_{\text{Test}} = 4.664$ ), comparing to that of baseline block ( $M_{\text{Baseline}} = 4.335$ ).

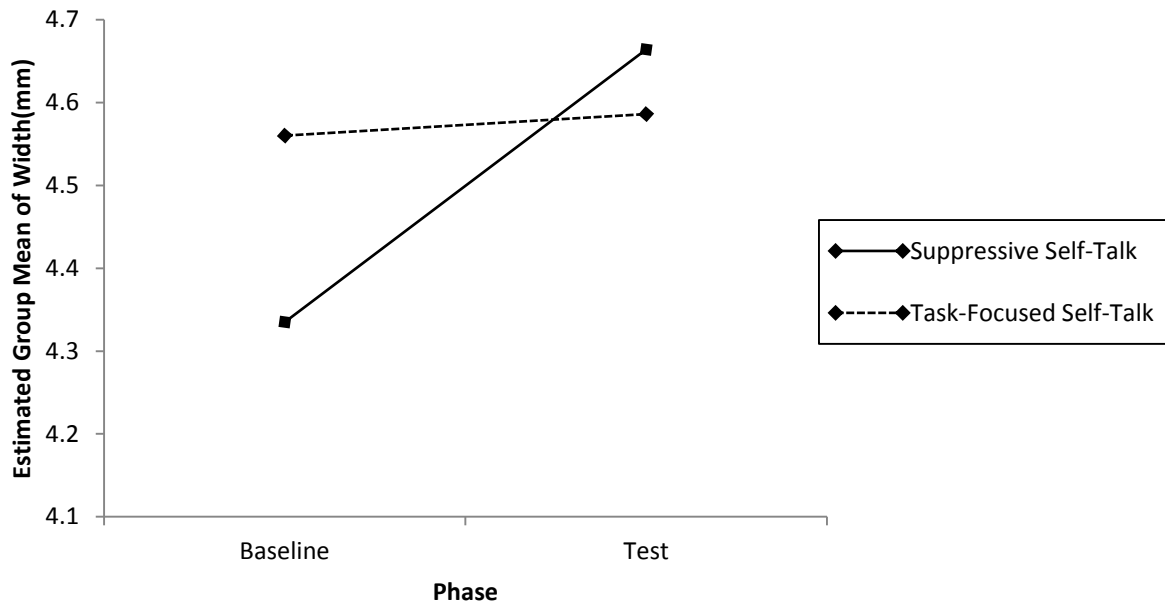


Figure 7. Means of width median by Phase and Attention (Self-Talk)

The fifth hypothesis was the most central in the study. According to the ironic processing theory (Wegner, 1994), the participant group (i.e., HPSS) receiving suppressive self-talk (i.e., “Don’t Shake”) and under high pressure (i.e., fake time constraint) would experience a greater performance deterioration compared to the other three groups (i.e., HPFS, LPSS, LPFS). However, in the current study, there was not a significant interaction among Attention, Pressure, and Phase,  $F(1, 71) = 2.599, p = .111, \eta_p^2 = .035$ . Taking a look at the changes of the four groups from baseline block to test block (see Figure 8), it seemed that the HPSS group experienced performance drop just like the HPFS and LPSS groups and LPTS group experienced certain performance enhancement. Therefore, the fifth hypothesis was not supported.

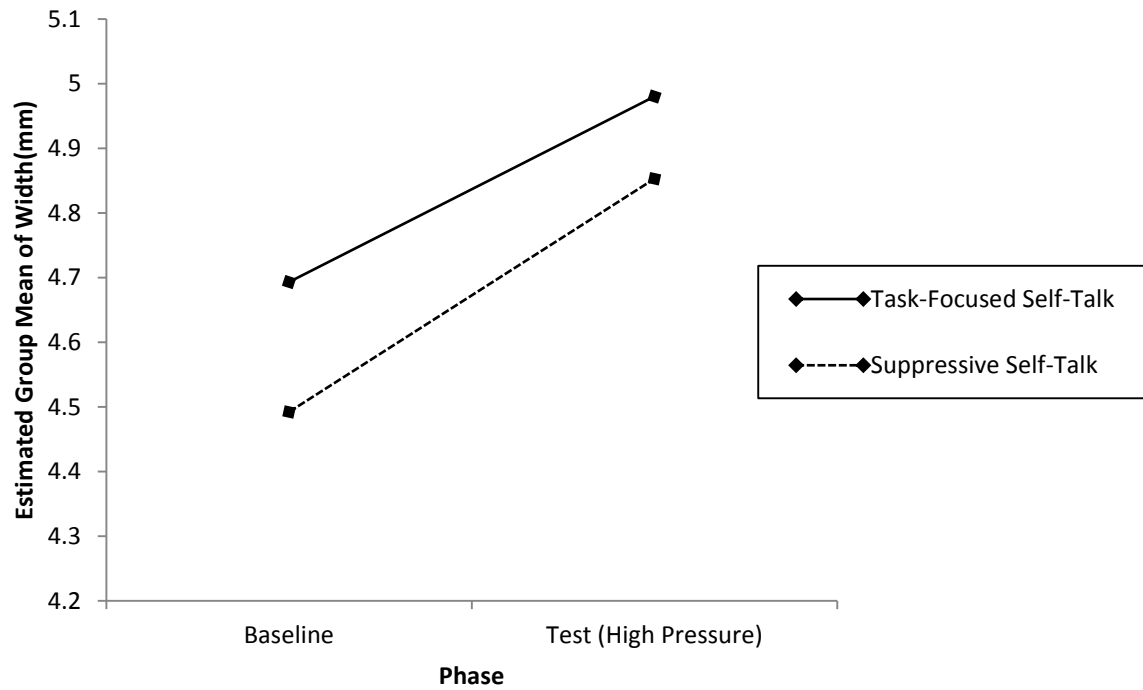
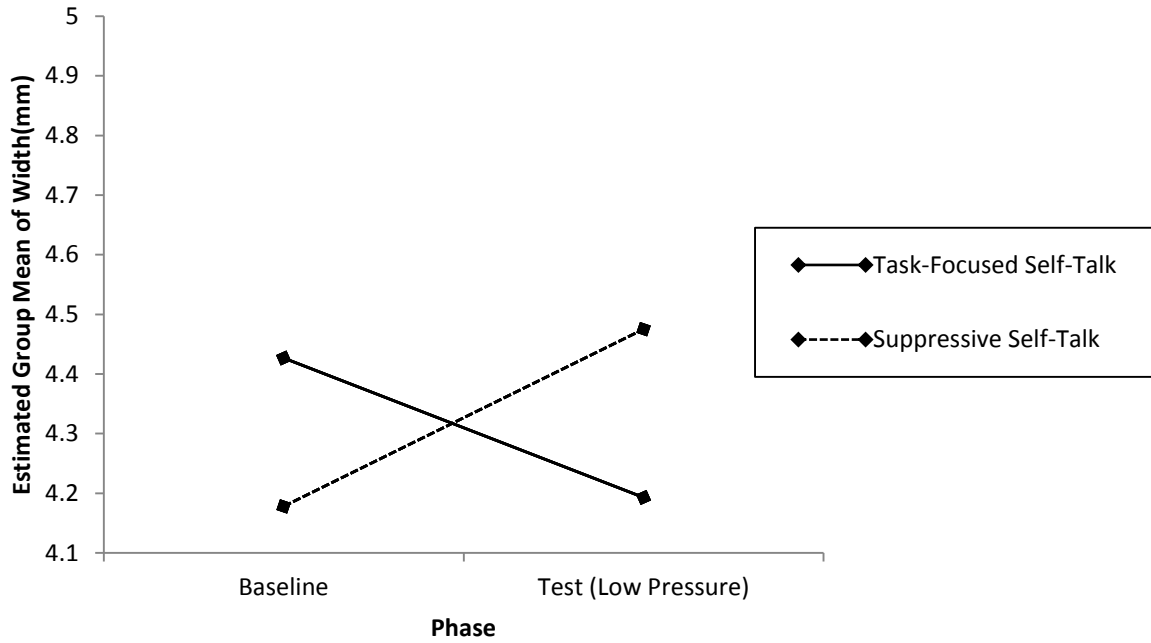


Figure 8. Means of width median by Phase and Attention (Self-Talk), separated by Pressure

### Comparison between SCL and Pressure Ratings

The final hypothesis was that SCL should demonstrate similar result pattern in RM ANOVA as do pressure ratings. The mean SCL readings of the time period for the baseline and test blocks, respectively, were input as the within-participant factor in RM ANOVA. However, the similarity between SCL and pressure ratings in measuring pressure level is not substantial and thus the hypothesis was not supported. The RM ANOVA results regarding SCL showed that there was a significant main effect of Phase,  $F(1, 71) = 3.391, p = .050, \eta_p^2 = .053$ , and a significant interaction between Phase and Order,  $F(1, 71) = 28.572, p = .000, \eta_p^2 = .287$ . The interaction between Phase and Order was shown in Figure 9. According to the graph, SCL readings of the test block were always higher than those of the baseline block. Nevertheless, unlike pressure ratings, the interested interaction effect between Phase and Pressure did not reach significance,  $F(1, 71) = 1.285, p = .261, \eta_p^2 = .018$  (the group means of the Phase by Pressure interaction was shown in Figure 10). Consequently, there seemed not to be a close relationship between pressure ratings and SCL because the Phase by Pressure interaction was manifested in pressure ratings as it did not here in the SCL readings.



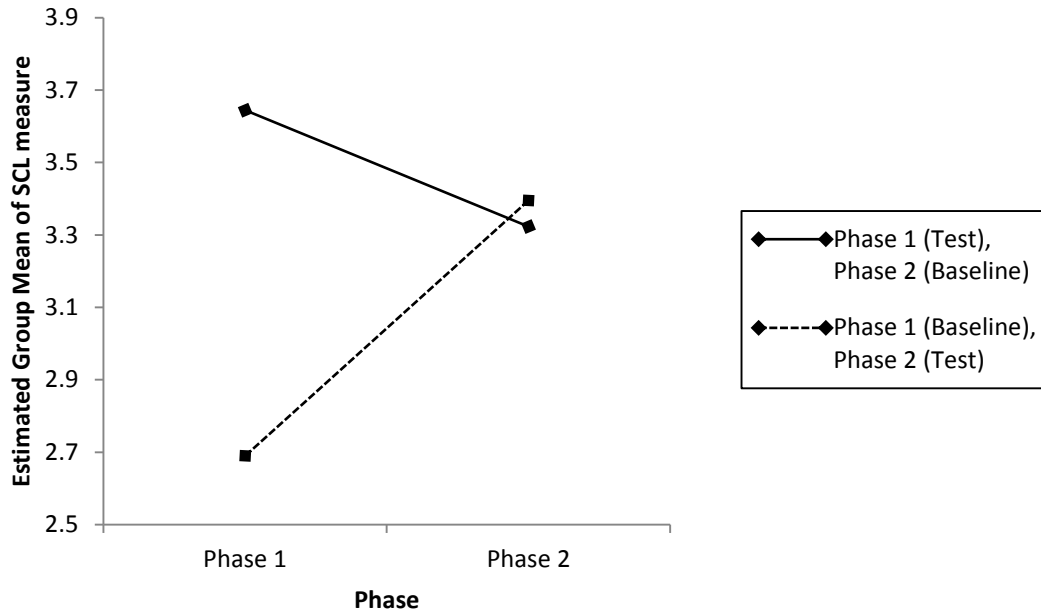


Figure 9. Means of SCL by Phase and Order

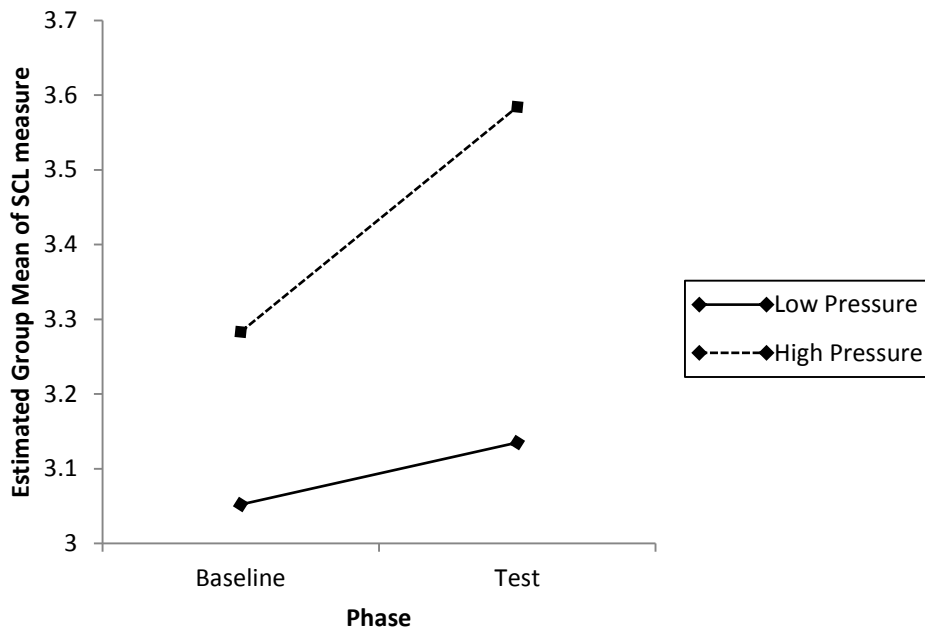


Figure 10. Means of SCL by Phase and Pressure

## CHAPTER 5

### DISCUSSION AND CONCLUSIONS

The present study was an effort to unfold the mechanism underlying “Choking under Pressure” phenomenon. Traditionally, there are two attentional approaches to explain the mechanism of choking. The first one follows the framework of *Distraction Theory* (Baumeister & Showers, 1986). It posits that choking phenomenon occurs because the performer fails to allocate attention to and make good use of information critical to performance. Pressure plays the role of having performers become susceptible to the distracters and thus undermines their performance. The other approach is under the guidance of several similar theories (i.e., *Explicit Monitoring Theory*, *Self-Focused Model*, and *Theory of Reinvestment*). Researchers from this approach alleged that choking under pressure emerges when performers tend to draw attention inward and follow a step-by-step process of skill execution. This is damaging because it disrupts well-learned and proceduralized performance processes that normally runs outside of conscious awareness (Beilock & Carr, 2001; Lewis & Linder, 1997; Masters, 1992). According to *Theory of Skill Acquisition* (Anderson, 1982, 1983; Fitts & Posner, 1967), however, both approaches address only one facet of choking under pressure because each approach’s explanatory boundary seemed to be circumscribed by athletes’ level of expertise.

Unlike the traditional approaches to choking phenomenon, the current research was grounded in Wegner (1994)’s ironic processing theory and aimed to test another source for choking. In the theory, Wegner tried to analyze the mechanisms inside the working memory by proposing two parallel processes (i.e., operating process and monitoring process). He predicts that performers choke when trying to suppress certain improper thoughts during performance and

that mental load facilitates choking by bringing down attentional resources for thought-suppression (Wegner, 1994).

The main purpose of present investigation was to further investigate the predictions of ironic processing theories using fine motor skills (i.e., hand motion steadiness). It involved time constraint as pressure manipulation and self-talk as director of attentional focus. Even though there may be a speed-accuracy tradeoff issue by employing a fake time constraints in the pressure manipulation, the discussion of speed-accuracy tradeoff is beyond the scope of this study. Nonetheless, the study focused on discussing sources of choking phenomenon, among which speed-accuracy tradeoff could well become an alternative (Accot & Zhai, 1997; Jordet, 2009). Besides, the design of the study included participants performing under no time constraints as control. Therefore, making adjustments on these participants according to the speed-accuracy rules (Accot & Zhai, 1997) would make no sense out of the comparison with participants performing under the fake time constraints.

### **Ironic Process and Choking**

It was found in the present study that there was indeed an ironic effect occurred for the group doing the suppressive self-talk (“Don’t Shake”), whereas group doing task-focused self-talk (“Go Steady”) enjoyed a steady performance, regardless of the pressure manipulation (see Figure 7). Besides, both suppressive self-talk and task-focused self-talk groups suffered from the pressure of fake time constraint and experienced performance decrement, or choking under pressure (see Figure 6). Even though the test of most interested hypothesis from the ironic processing theory does not reach significance, the  $p$  value (i.e.,  $p < .111$ ) is close to the statistical cut-off point and the group pattern is still interesting to check out (see Figure 8). It seemed that, at low pressure, repeating “Go Steady” to oneself enhanced one’s performance and saying

“Don’t Shake” would cause oneself to choke. However, at high pressure, participants choked in independence of the self-talk content. This replicated exactly the result pattern in a former research (Dugdale & Eklund, 2003) and thus challenged to the role of mental load in ironic processing theory.

In the literature, there were quite a few ironic-effect studies done without employing mental load (Beilock et al., 2001; Bakker, Oudejans, Binsch, & Kamp, 2006; Binsch, et al., 2010; Macrae, et al., 1994; Wegner, et al., 1987). Some researchers argued, for instance, the key for the ironic process lies in the frequency of thought suppression, instead of mental load (Beilock et al., 2001; Macrae, et al., 1994). Therefore, one explanation for the results pattern in Figure 8 might be that the pressure of time constraint lowered the frequency of subvocal self-talk during the task. This explanation receives support from the perspective of distraction theory (Baumeister & Showers, 1986) and theory of skill acquisition (Anderson, 1982, 1983; Fitts & Posner, 1967). The main task in the current study involves fine motor movement of the hand and all the COE students are performing it for the first time. Therefore, it is reasonable to assume that these participants are at a novice level of executing the skill. Even though subvocally rehearsing cue words while doing the task would consume certain amount of attentional resource, this cost should be relatively minor comparing to the effect of the attentional focus (directed by different self-talk words) in the low pressure manipulation. It is because, instead of both getting choked, the performance of LPTS group got enhanced by rehearsing “Go steady” and opposite pattern was found for LPSS group rehearsing “Don’t shake”. Nonetheless, the situation seems totally different when the pressure of time constraint was added to relevant participants. This informed time limit led those participants to such a strong awareness of time control that they performed about half the time of their counterparts did under low pressure condition (see Table 1). In

addition, among the 41 participants filtered out of the study by failing to adhere to the self-talk cue words, 29 of them received high pressure manipulation. Therefore, it seems fair to argue that the (fake) time constraint is an influential distracter because it not only exhausts one's attention resource but also damps attentional focus effect by reducing cue word rehearsal frequency.

There may be another reason for those high-pressure participants to slower their cue word rehearsal in the current study. That is, the cue words are not their own ones but imposed by researchers. It is very often for athlete to use their habitual self-talk while coping with high pressure situation. For instance, Mr. Matthew Emmons was telling himself "Don't hold up, don't dress it up, just make it the best you can" immediately before he fired the last shot in 50 m three-positions rifle final of 2012 London Olympics (D'Alessandro, 2012, para. 14). This was followed by a shot of 7.6 points, the worst one of Emmons' finals round. For him, it makes sense that high pressure situation (i.e., the final shot in the Olympic finals) heightened the strength and frequency of his personal coping processes, although his suppressive self-talk content seems debilitating. In general situations, it also seems usual for people to cope with high pressure situation by doing self-talk. However, if the self-talk cue words are not part of people's spontaneous coping process (e.g., the researcher-created cue words "Don't shake" and "Go steady" in the present experiment), they would likely be neglected by participants due to narrowed attention span under high pressure situation. These points need to be further explored in the future.

One unexpected finding of the present study was that women's hands seemed more stable across conditions than men's hands. Even though there was evidence that young girls (Gesell, Halverson, Thompson, Ilg, Castner, Ames, & Amatruda, 1940; McNemar, 1942, as cited in Broverman, Klaiber, Kobayashi, & Vogel, 1968) and adult women (Tiffin & Asher, 1948)

exceed their male counterparts in tasks of fine manual dexterity, no findings, at least to the awareness of the author, have stated that females' hand motion is more stable than that of males under varied conditions of pressure level and attentional focus. This finding could generate valuable applications, as many tasks in real life involve characteristics of the present experiment. However, this result needs to be replicated before any generalization could be made.

There are several applied points that could be raised from the foregoing discussion. Firstly, ironic process is a source for choking and athletes need to develop certain habit or skill in order to prevent it. For example, Van Der Kamp (2006) found that, in soccer penalty shoot, players could enjoy better performance if they chose a keeper-independent strategy (i.e., kicker chooses the target location in advance disregarding the action of the keeper during the run-up) than a keeper-dependent strategy (i.e., kicker chooses the target location depending on the action of the keeper during the run-up). Secondly, because it is unavoidable for some sports to have time constraints, it is beneficial to help athlete be aware of the time and score even in the informal setting (e.g., training). This could help decrease athletes' anxiety by time constraints (Lox, Martin Ginis, & Petruzzello, 2003, p. 268). Finally, Wulf (2007) argued that people perform the motor task best when they focus on their movement effect (e.g., tennis player focus on the location he/she wants to serve) (p. 113). Therefore, trainers may want to help athlete develop a habit or training program of focusing on movement effect across contexts (training, game, etc.).

### **Pressure and Pressure Measurement**

The present study had both SCL reading and self-report of pressure level from participants. Whereas pressure ratings plays the role of manipulation check for pressure, SCL readings was incorporated mainly for the purpose of further examining its validity in measuring

pressure perception. According to the results, there was a significant Phase and Order interaction for the SCL readings and this referred to the fact that the SCL readings of the test block (when various manipulations were administered on participants) are higher than those of the baseline block. Because all the participants had additional task of subvocal rehearsal in the test block comparing to the baseline block, they are supposed to have a higher arousal level to meet the requirement of the task. However, unlike pressure ratings, no significant result of Phase and Pressure interaction was identified for SCL readings. It seems that SCL readings are not sensitive to the change of perceived pressure level for the following reasons. Firstly, a relatively low activation level may be preferable in order to steady one's hand for the task requirement and hence participants may consciously control their SNS activity in order to get a better score. Considering the evidence that shooters lower their SCL in their performance (Caterini, et al., 1995; Tremayne & Barry, 2001), the repressed SCL level does not necessarily imply anything about one's pressure perception. Moreover, it has been argued that SCL has a 2 seconds latency of electrodermal activity (Tremayne & Barry, 2001). Because participants receiving high pressure manipulation completed their task with a mean of about 5.5 seconds, this latency may well mask certain amount of effects. In short, SCL measures one' activation-arousal level per se (Salazar, et al., 1990; Tremayne & Barry, 2001) and it is not a good indicator of one's pressure level in the present study.

In the future, researchers need to pay cautious attention when choosing biofeedback indicators. For example, there is evidence (Salazar, et al., 1990; Tremayne & Barry, 2001) that heart rate (HR) and SCL may measure different constructs for sports involving minor physical demands (e.g., marksmanship, golf putting, and sprint start). More specifically, HR is treated as an indicator of vigilance (i.e., attentive state with focus on external stimulus events) and SCL

activation-arousal level in those situations. However, in more physically demanding tasks, the cognitive effect on HR and SCL could be overrode by physiological factors and thus they would become indicators of other constructs. Future academic endeavors on clarifying these issues are recommended.

### **Limitations and Future Directions**

There are several limitations in the current study. First, the study did not measure the SCL and pressure ratings during the participants' rest period (i.e., pre-test, rest interval between blocks, and post-test). These measurements could offer a new perspective on making comparisons of pressure level and hence make the interpretation more informative. Second, there was no post-experiment interview conducted. The qualitative data from the participants is beneficial for researchers to understand what participants were going through during the experiment and to better interpret the quantitative results. Lastly, guidance of the ironic processing theory (Wegner, 1994) may also has limitations for integrating the whole picture of choking under pressure and future theoretical efforts are needed.

### **Conclusions**

In the current study, Wegner (1994)'s ironic processing theory was supported for being able to predict one source of choking, especially when the pressure level was low. Under conditions of high pressure (e.g., perceived time constraints), however, the prediction of the theory was not supported. Moreover, participants' subjective ratings of their pressure level seemed to be more indicative of their performance than the measurement of SCL and SCL is indeed a measure of one's activation-arousal level. Finally, women seem to have a more steady hand under various conditions in the study than do men.



## APPENDIX A

### INFORMED CONSENT FORM

**Study Title:** The Relationship between Motion Steadiness and Skin Conductance Level.

You are invited to be in a research study examining the relationship between motion steadiness and skin conductance level. You were selected as a possible participant because you indicated interest in participate in this research and are able to perform the task. We ask that you read this form and ask any questions you may have before agreeing to be in the study. This study is being conducted by Sicong Liu, as part of a Master thesis requirement by the department of Educational Psychology and Learning Systems, Sport Psychology program at Florida State University

**Background Information:**

The purpose of this study is to examine the relationship between motion steadiness and skin conductance level.

**Procedures:**

(If you agree to be in this study, we would ask you to do the following things)

You will perform a hand motion steadiness task using your dominant hand under different conditions. This task involves moving a ring stylus through a progressively narrowing stainless steel groove path. A beep gives the feedback while the stylus touches any part of the steel groove. Width of the path at that point will be videotaped and measured. Your skin conductance level of subdominant hand will also be measured by a device and its readings will be recorded by a laptop. You will be asked a few questions after the experiment. The whole process should take less than one hour.

**Risks and benefits of being in the Study:**

You understand that you will be at minimal risk to harm during this study. If at any time you experience any emotional or physical discomfort with the task involved in the study, you may freely discontinue participation.

The benefits of participation include that you will receive one credit hour towards the COE participant pool requirement and that this study provides information and knowledge regarding relevant areas.

**Confidentiality:**

The records of this study will be kept private and confidential to the extent permitted by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a participant. Research records will be stored securely and only researchers will have access to the records.

**Voluntary Nature of the Study:**



APPENDIX B

DEMOGRAPHIC INFORMATION FORM

Please fill out the following information about yourself:

1. ID # (*last four digits of your cellphone number plus number of your day of birth: cccdd*)

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2. Age \_\_\_\_\_

3. Gender (Male or Female)

4. Are you right- or left- handed? (Left or Right)

5. Do you have any vision disability even with the visual aids (such as glasses, contact lens, and so on)? (Yes or No)

6. Do you have any upper limb disability or deformity that you cannot perform the task of this study? (Yes or No)

Date \_\_\_\_\_

APPENDIX C

POST-EXPERIMENTAL SURVEY

ID # (last four digits of your cellphone number plus number of your day of birth: cccdd)

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According to your feelings while performing the task of current research, please try to answer the following questions by giving the most accurate estimation on a 1-7 Likert scale.

1. After you repeated the phrase ["Don't Shake"/"Go Steady"], to what extent did you remember it, or keep hearing it in your mind while performing the task?

Not paying attention at all

Paying complete attention

1      2      3      4      5      6      7

2. Please rate the amount of pressure felt during the **Non-verbal Session** of the task?

No pressure at all

Extremely huge amounts

1      2      3      4      5      6      7

3. Please rate the amount of pressure felt during the **Verbal Session** of the task?

No pressure at all

Extremely huge amounts

1      2      3      4      5      6      7

Date \_\_\_\_\_

## APPENDIX D

### INSTRUCTION SCRIPT

- Hello, my name is Sicong Liu. Welcome to my study.
- First of all, please read this informed consent form and sign on it if you feel no problem being the participant of this study, and keep one blank copy of it.
- Please fill out this demographic information form.
- According to the information you provided, it is clear that you are *RIGHT/LEFT* –handed and you will use this dominant hand to perform the main task of this experiment on this curved path (we will not use the straight path or the holes). At the same time, two electrodes will be attached to your non-dominant hand to measure your skin conductivity. Please be aware that none of these equipments will post any physical risk to you.
- Now you have a few minutes to practice 10 trials of the task. You are supposed to start from the middle point of the curve marked 10 (which is the widest point in the path) and you can choose to go either side (go left/right, because they are symmetrical) during this practice period. However, you have to choose one direction (Left/Right) after this practice period and the direction would be fixed for the rest of this experiment. If the stylus touches the bottom, the red light will shine. You cannot let the light shine (so just keep the stylus in the air). If the stylus touches the sides of the path, a beeping sound will indicate this touch and you should stop moving.
- Please be informed that you should grab the stylus exactly the way you grab a pen and your fingers are not allowed to pass certain point (Show it to participants). Also, about one third of the stylus tip should be under the task plane while the tip is kept perpendicular to the plane during your performance. Finally, the arm performing the task is not allowed to rely on the desk and the other arm should lie on the desk in a comfortable position without touching the equipment. By the way, you are not allowed to move the stylus merely by moving your wrist while fixating your arm! Please do not put your head too close to the task plane so that the hand motion is blocked from the video camera. Any questions about what I said (Explain again when necessary)?
- Please start your practice now and I will be adjusting the equipments for you. (Attaching electrodes)
- Finished practice? Please select a paper (out of eight of them) for further instruction.

(Instructing accordingly among 1-8 groups)

- Have you given your email address? If not, you may want to reconsider it because what you know about the experiment is only part of the story. I will email to you a more detailed description of what the experiment is trying to look at. Besides, I need your email address to contact you for the gift card if you won the lottery. Here is your credit slip. (Sign for the participant)

*No Feedback to Participant*

*No Trial Number Released to Participant*

## 1. HPFS-baseline block and experiment block

- Baseline: Now, I will have you perform several trials of the task. There will be no time limit for any single trial. For each trial, you are expected to pay all your attention to moving the stylus along the path as far as you can. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “prepare”, you are suppose to put the tip in the middle point of the path and be ready to start. After you hear me say “start”, you should start to move the stylus right away. (Comcorder ON!)

(Collect Response to Question 2)

(5 min rest, assigning credits, avoid talking)

- Experiment: Now, I want you to perform some other trials of the task. However, there will be a 9-sec time limit for every single trial. Please be aware that this 9 sec time limit is connected to our lottery. It means that the more times that you violate this rule, your chance to get the Starbucks gift card would be lowered. Besides, you need to loudly repeat (so that I could hear it) the instruction phrase “Go steady” in your native language for 10 s right before you start each trial. And when you are performing the task, I want you to continue hearing “Go steady” in your mind. I will be responsible of controlling the time for you. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “repeat”, you should start to say the instruction “Go steady” until you hear me say “prepare”, at which time you are suppose to put the tip in the middle point of the path and be ready to start. After hearing me say “start”, you should start to move the stylus right away.  
(*Emphasizing time limit before each trial*) (Comcorder OFF!)

(Collect Response to Question 1 & 3)

## 2. HPFS-experiment block and baseline block

- Experiment: Now, I want you to perform some trials of the task. Please be cautious that there will be a 9-sec time limit for every single trial you perform. Please be aware that this 9

sec time limit is connected to our lottery. It means that the more times that you violate this rule, your chance to get the Starbucks gift card would be lowered. Besides, you need to loudly repeat (so that I could hear it) the instruction phrase “Go steady” in your native language for 10 s right before you start each trial. And when you are performing the task, I want you to continue hearing “Go steady” in your mind. I will be responsible of controlling the time for you. Could you repeat the instructions so that I am sure you understand all of them?

- When I say “repeat”, you should start to say the instruction “Go steady” until you hear me say “prepare”, at which time you are suppose to put the tip in the middle point of the path and be ready to start. After hearing me say “start”, you should start to move the stylus right away. (Comcorder ON!)

*(Emphasizing time limit before each trial)*

(Collect Response to Question 1 & 3)

(5 min rest, assigning credits, avoid talking)

- Baseline: Now, I will have you perform several trials of the task. There will be no time limit for any single trial. For each trial, you are expected to pay all your attention to moving the stylus along the path as far as you can. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “prepare”, you are suppose to put the tip in the middle point of the path and be ready to start. After you hear me say “start”, you should start to move the stylus right away. (Comcorder OFF!)

(Collect Response to Question 2)

### 3. HPSS-baseline block and experiment block

- Baseline: Now, I will have you perform several trials of the task. There will be no time limit for any single trial. For each trial, you are expected to pay all your attention to moving the stylus along the path as far as you can. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “prepare”, you are suppose to put the tip in the middle point of the path and be

ready to start. After you hear me say “start”, you should start to move the stylus right away. (Comcorder ON!)

(Collect Response to Question 2)

(5 min rest, assigning credits, avoid talking)

- Experiment: Now, I want you to perform some other trials of the task. However, there will be a 9-sec time limit for every single trial. Please be aware that this 9 sec time limit is connected to our lottery. It means that the more times that you violate this rule, your chance to get the Starbucks gift card would be lowered. Besides, you need to loudly repeat (so that I could hear it) the instruction phrase “Don’t shake” in your native language for 10 s right before you start each trial. And when you are performing the task, I want you to continue hearing “Don’t shake” in your mind. I will be responsible of controlling the time for you. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “repeat”, you should start to say the instruction “Don’t shake” until you hear me say “prepare”, at which time you are suppose to put the tip in the middle point of the path and be ready to start. After hearing me say “start”, you should start to move the stylus right away.  
(*Emphasizing time limit before each trial*) (Comcorder OFF!)

(Collect Response to Question 1 & 3)

#### 4. HPSS-experiment block and baseline block

- Experiment: Now, I want you to perform some trials of the task. Please be cautious that there will be a 9-sec time limit for every single trial you perform. Please be aware that this 9 sec time limit is connected to our lottery. It means that the more times that you violate this rule, your chance to get the Starbucks gift card would be lowered. Besides, you need to loudly repeat (so that I could hear it) the instruction phrase “Don’t shake” in your native language for 10 s right before you start each trial. And when you are performing the task, I want you to continue hearing “Don’t shake” in your mind. I will be responsible of controlling the time for you. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “repeat”, you should start to say the instruction “Don’t shake” until you hear me



say “prepare”, at which time you are suppose to put the tip in the middle point of the path and be ready to start. After hearing me say “start”, you should start to move the stylus right away. (Comcorder ON!)

*(Emphasizing time limit before each trial)*

(Collect Response to Question 1 & 3)

(5 min rest, assigning credits, avoid talking)

- Baseline: Now, I will have you perform several trials of the task. However, there will be no time limit for any single trial. For each trial, you are expected to pay all your attention to moving the stylus along the path as far as you can. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “prepare”, you are suppose to put the tip in the middle point of the path and be ready to start. After you hear me say “start”, you should start to move the stylus right away. (Comcorder OFF!)

(Collect Response to Question 2)

#### 5. LPSS-baseline block and experiment block

- Baseline: Now, I will have you perform several trials of the task. There will be no time limit for any single trial. For each trial, you are expected to pay all your attention to moving the stylus along the path as far as you can. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “prepare”, you are suppose to put the tip in the middle point of the path and be ready to start. After you hear me say “start”, you should start to move the stylus right away. (Comcorder ON!)

(Collect Response to Question 2)

(5 min rest, assigning credits, avoid talking)

- Experiment: Now, I want you to perform some other trials of the task. Again, there will be no time limit for any single trial. However, you need to loudly repeat (so that I could hear it) the instruction phrase “Don’t shake” in your native language for 10 s right before you start each trial. And when you are performing the task, I want you to continue hearing “Don’t shake” in your mind. I will be responsible of controlling the timing for you. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “repeat”, you should start to say the instruction “Don’t shake” until you hear me say “prepare”, at which time you are suppose to put the tip in the middle point of the path and be ready to start. After hearing me say “start”, you should start to move the stylus right away. (Comcorder OFF!)

(Collect Response to Question 1 & 3)

#### 6. LPSS-experiment block and baseline block

- Experiment: Now, I want you to perform some trials of the task. There will be no time limit for any single trial. However, you need to loudly repeat (so that I could hear it) the instruction phrase “Don’t shake” in your native language for 10 s right before you start each trial. And when you are performing the task, I want you to continue hearing “Don’t shake” in your mind. I will be responsible of controlling the timing for you. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “repeat”, you should start to say the instruction “Don’t shake” until you hear me say “prepare”, at which time you are suppose to put the tip in the middle point of the path and be ready to start. After hearing me say “start”, you should start to move the stylus right away. (Comcorder ON!)

(Collect Response to Question 1 & 3)

(5 min rest, assigning credits, avoid talking)

- Baseline: Now, I will have you perform several other trials of the task. Again, there will be no time limit for any single trial. For each trial, you are expected to pay all your attention to moving the stylus along the path as far as you can. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “prepare”, you are suppose to put the tip in the middle point of the path and be

ready to start. After you hear me say “start”, you should start to move the stylus right away. (Comcorder OFF!)

(Collect Response to Question 2)

#### 7. LPTS-baseline block and experiment block

- Baseline: Now, I will have you perform several trials of the task. There will be no time limit for any single trial. For each trial, you are expected to pay all your attention to moving the stylus along the path as far as you can. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “prepare”, you are suppose to put the tip in the middle point of the path and be ready to start. After you hear me say “start”, you should start to move the stylus right away. (Comcorder ON!)

(Collect Response to Question 2)

(5 min rest, assigning credits, avoid talking)

- Experiment: Now, I want you to perform some other trials of the task. Again, there will be no time limit for any single trial. However, you need to loudly repeat (so that I could hear it) the instruction phrase “Go Steady” in your native language for 10 s right before you start each trial. And when you are performing the task, I want you to continue hearing “Go steady” in your mind. I will be responsible of controlling the timing for you. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “repeat”, you should start to say the instruction “Go steady” until you hear me say “prepare”, at which time you are suppose to put the tip in the middle point of the path and be ready to start. After hearing me say “start”, you should start to move the stylus right away. (Comcorder OFF!)

(Collect Response to Question 1 & 3)

## 8. LPTS-experiment block and baseline block

- Experiment: Now, I want you to perform some trials of the task. There will be no time limit for any single trial. However, you need to loudly repeat (so that I could hear it) the instruction phrase “Go Steady” in your native language for 10 s right before you start each trial. And when you are performing the task, I want you to continue hearing “Go steady” in your mind. I will be responsible of controlling the timing for you. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “repeat”, you should start to say the instruction “Go steady” until you hear me say “prepare”, at which time you are suppose to put the tip in the middle point of the path and be ready to start. After hearing me say “start”, you should start to move the stylus right away. (Comcorder ON!)

(Collect Response to Question 1 & 3)

(5 min rest, assigning credits, avoid talking)

- Baseline: Now, I will have you perform several other trials of the task. Again, there will be no time limit for any single trial. For each trial, you are expected to pay all your attention to moving the stylus along the path as far as you can. Could you repeat the instructions so that I am sure you understand all of them?
- When I say “prepare”, you are suppose to put the tip in the middle point of the path and be ready to start. After you hear me say “start”, you should start to move the stylus. (Comcorder OFF!)

(Collect Response to Question 2)

## APPENDIX E

### DEBRIEFING SCRIPT

The research you are involved contains a deception which hides the true purpose of the present study. The real purpose of the study is not to see what you were told (i.e., the relationship between motion steadiness and skin conductance level). It is to test whether there is an ironic effect of your attentional focus (controlled by self-talk cue words) in affecting your hand motion steadiness, especially when you are under pressure. More specifically, if you were assigned to an experimental condition which required you to do an explicit suppressive self-talk (“Don’t Shake”) while under the pressure of a fake time constraint, your performance will be much worse than your performance in other normal conditions (e.g. under low pressure, doing task-focused self-talk “Go Steady”). Moreover, this study also test to see other research questions, such as gender difference and relationship between subjective self-reported pressure level and level of skin conductivity (FYI, the pressure level is objectively measured by skin conductance level). Because your insight of this purpose will bring confounding factors to your data, the investigator (Sicong Liu) thus chooses to present a pseudo one.

This debriefing script was not released to you immediately after your participation. It is because all of you are from the COE participant pool and you may know each other in your classes. Therefore, some of you with insight of this study may reveal its true purpose to potential future participants and undermine their naivety to the study. As for the data collection has been finished, it is the investigator’s responsibility to have you informed of what he really wants to look at in his study.

Now that you are given a chance to know what the study truly investigates and you are free to choose whether or not your data will be retained for future analysis. Please be aware that, if you do not want your data to be used, it will not hurt your relationship with any parties or persons. What is your choice? (Please email me back if you do not want your data to be used for statistical analysis.)

Do you have any question? If you do, please ask the investigator directly via email (\*\*\*\*\*@my.fsu.edu). Again, thank you very much for your participation!

Sicong Liu

APPENDIX F

HUMAN SUBJECT COMMITTEE APPROVAL

Office of the Vice President For Research  
Human Subjects Committee  
Tallahassee, Florida 32306-2742  
(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM (for change in research protocol)

Date: 1/13/2012

To: Sicong Liu

Address: \*\*\*\*\*

Dept.: EDUCATIONAL PSYCHOLOGY AND LEARNING SYSTEMS

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research (Approval for Change in Protocol)

Project entitled: A Source of Choking under Pressure: The Ironic Effect of Self-Talk in a Motion Steadiness Test

The form that you submitted to this office in regard to the requested change/amendment to your research protocol for the above-referenced project has been reviewed and approved.

If the project has not been completed by 10/10/2012, you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

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

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is FWA00000168/IRB number IRB00000446.

Cc: Robert Eklund, Advisor  
HSC No. 2011.7258

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## BIOGRAPHICAL SKETCH

Sicong Liu was born in Jinan, Shandong province, China, in the late 1980s. Under the influence of *One Child Policy* in China, he is the only child in the family. However, Sicong never felt lonely by himself because he has many friends around him and he is close to children of his parents' many siblings. With the open of China followed by fast economy growth, Sicong's parents tried their best to provide him with all the resources of the family and hence he developed many skills and hobbies. Sicong likes playing piano, singing, and drawing. He is also good at sports and he has tried soccer, basketball, swimming, and 400 meter running. Sicong began to practice Tai Chi (a traditional Chinese martial art) in his sophomore year of college and he finished a B. S. degree in Applied Psychology at Beijing Normal University, Zhuhai at 2010. Throughout the years of practicing Tai Chi, Sicong was intrigued by the interaction between human body and mind and thus decided to pursue a Ph. D. degree in Sports Psychology at Florida State University. Sicong's application for the graduate school turned out to be successful and he won the Presidential University Fellowship. Sicong wants to be a professor and researcher in the future and he is working hard to achieve these goals.