The Journal of Undergraduate Research

Volume 14 *The Journal of Undergraduate Research* Article 2

2016

The Contributions of Body Awareness to "Choking under Pressure"

Wagner Larson
South Dakota State University

Cody Larson
South Dakota State University

The Contributions of Body Awareness to "Choking under Pressure"

Authors: Wagner Larson, Cody Larson

Faculty Sponsor: Tyler Miller, Ph. D.

Department: Psychology

Abstract

"Choking under pressure" is a well-known phenomenon that occurs when performance is negatively affected because of perceived pressure. Many researchers have studied this topic, mainly verifying the key theories involved: the explicit monitoring theory and distraction theory. The current study adds to the literature by measuring the contributions of body-awareness to choking under pressure. Research on the concept of overthinking body movements supports the hypothesis that the more self-aware individuals are of their bodies, the more they are subject to choking in a high pressure situation. The current study aims to expand this idea by examining tactile awareness as another body-awareness factor. The study investigated the impact of pressure on performance in a golf-putting task, testing the hypothesis that participants who ranked high in body awareness would perform more poorly in the pressure group than those who ranked low in body awareness. **Keywords:** choking, body-awareness, explicit monitoring, distraction theory, performance

Introduction

Professional athletes often started their careers early in elementary school, sometimes as soon as they can walk. The most determined of athletes may spend multiple hours training every day, working to master their specific skill. For example, basketball players might practice their shots every night in an empty gymnasium, in an attempt to gain a competitive advantage by improving and perfecting this specific skill. In this setting there is no pressure, no screaming fans, and no chance to win or lose the game. Dedicated athletes practice their skills in these types of settings hoping that the amount of time they spend practicing will improve their performance in an actual game. However, practicing in an empty gym does not always transfer over to a game, especially when the stakes are high. The presence of an opposing crowd or trying to win the championship game may add pressure or concerns that were not present in the empty gym.

Often times, during a performance, people feel anxiety to perform well. When the stakes are elevated, performance pressure tends to elevate as well. This could not only apply to a game-winning shot, but a solo in a musical performance or any other situation in which the pressure is abnormally high. Increased pressure is often accompanied by anxiety, which can negatively impact performance (Wine, 1971). This is also known as choking under pressure (Baumeister, 1984). Choking under pressure is performing relatively worse than one normally would with the absence of pressure (Wine, 1971). Failing to effectively execute a skill in the situation that requires it most can result in losing a game, job, or in extreme circumstances, one's life. There are two main theories that attempt to explain the complexity of choking under pressure: the explicit monitoring theory and the distraction theory.

Explicit Monitoring Theory

The explicit monitoring theory focuses on explicit and implicit skills. In this framework, a skill that is practiced enough will eventually become implicit when it requires no conscious thought to perform. Explicit skills, on the other hand, are made up of facts that one can articulate. For example, an explicit definition of shooting a free throw could be the details of the routine, dribbling or spinning the ball, holding the ball cocked back and close to one's face, lifting the basketball then following through. After enough repetition, this explicit knowledge becomes automatic or implicit. According to Masters (1992), skills acquisition begins with explicit encoding that over time becomes implicit, thereby lowering cognitive demands.

According to the explicit monitoring theory, the presence of pressure increases self-consciousness about performing well. As a result, one reverts back to the explicit, step-by-step processes of performing the skilled behavior (Beilock and Carr, 2001). In this case, an action that is done automatically is now consciously thought through, which can negatively impact performance (Baumeister, 1984). According to the explicit monitoring theory, a performer under pressure places attention on skill execution, when the mechanics of the skill would be task-irrelevant stimuli since optimal performance for an expert is implicit. For example, asking a pianist to explain, in detail, their hand movements during a performance causes them to perform worse, because the skill they already learned will revert back to their explicit knowledge of the skill, resulting in choking (Schmidt, 1982).

Support for the explicit monitoring theory can be seen in studies investigating the initial learning process. Masters (1992) investigated the separate processes of implicit and explicit learning by studying golf putting execution under manipulated amounts of pressure. It was hypothesized in Masters' study that adding a secondary task (requiring participants to call out random numbers systematically while putting) would result in a higher resistance to the added pressure if putting was learned implicitly as opposed to explicitly. The results did, in fact, reveal that the explicit learning groups failed more than the implicit learning groups in the high-pressure condition. We can conclude that, because of the added stimuli during the implicit learning group session, the participants' explicit knowledge was suppressed, making the learned putting task more automatic and less technical. Therefore, we can assume that the implicit group displayed a higher resistance to choking under pressure because of the way they practiced learning the putting skill, with no time for overthinking and added self-consciousness.

Even experts of a skill can fall victim to choking under pressure. Instead of observing initial learning, some researchers have focused on observing professionals to determine the rationale behind their poor performances under pressure. Gray (2004) used college baseball players to demonstrate how attention to a skill, and the specific mechanics during the execution of that skill, can significantly degrade performance. Focusing attention to a step-by-step processes of a skill had less influence on novices than on experts. Beilock and Gray (2012) went a step further to investigate this shift in attention by investigating not the result of the performance, but the actual movement of the expert during skill execution. This research demonstrates that focusing more attention on skill level of a task alters the expert's actual movements, which ultimately decreases overall performance because it is no longer an unconscious and natural skill. The emphasis of attention is a very important consideration for researchers studying choking under pressure. Where one's attention is focused during task performance can be crucial to the execution of the skill. The distraction theory is used to explain how this shift in attention may alter performance.

Distraction Theory

According to distraction theory, pressure to perform causes a diversion from task-relevant information during performance (Beilock and Carr, 2001). It is assumed that pressure can actually shift attention away from the task presented. These distractions can be either internal or external (Lewis and Linder, 1997). Internal distractions, for example, are when one's worry about the consequences of their actions occupy the majority of their attention. For instance, when a volleyball player is serving for the game winning point of a close match and the player is so focused on how the game could depend on this one serve, the amount of attention directed to this task could fundamentally alter the player's serve in a negative way. External distractions, on the other hand, consist of factors surrounding the performer that may disrupt their focus on the task. A singer, for example, may feel so nervous by the presence of a loved one that his or her attention is more focused on that person than hitting the high note in a solo performance.

The anxiety one feels in the presence of pressure has been widely studied. This anxiety is considered an internal distraction for the performer executing a task. Wine (1971) acknowledged the presence and effect of anxiety in studying people who struggled taking tests. This research illustrates how highly anxious people may divide their attention between self-relevant and task-relevant stimuli, which can be distracting towards performance. Beilock, Kulp, Holt, and Carr (2004) investigated this concept further by observing the effects of working memory capacity on performance under pressure. They used math-testing in the form of modular arithmetic, an algorithm-based style of arithmetic utilizing addition, subtraction, and division in a series of steps to compare values. Performance was quantified by correctly solving the problem. This was used as the dependent variable and pressure was manipulated by offering incentives, suggesting peer pressure, and a critical evaluation of performance. They found that those with a higher working memory tended to be more susceptible to performance failure when pressure was involved because their normally superior cognitive-powered strategies to skill execution tended to revert to short-cut strategies under pressure. Again, this demonstrates that lack of attention is a distraction during performance, especially when the individual is used to a more cognitively demanding route to skill execution. When fragments of attention are diverted to places other than the task at hand, an individual will choke under pressure.

Brain Activity and Choking

Both explicit monitoring theory and distraction theory coincide with particular cognitive processes dealing with motor control. Neuroimaging was recently used to examine the interaction between high states of pressure from monetary incentive and motor performance failure by directly observing changes in activity in the motor cortex and prefrontal cortex (Lee and Grafton, 2015). The functional connectivity between the prefrontal and motor cortex was found to be highest right before an individual "chokes" under pressure. This study supports the distraction theory by exemplifying the inability of attention and goal-directed activity in the prefrontal cortex to reach full potential while pressure is induced. By observing the lack of required activity in the brain necessary for optimal performance, we can infer that this is how one chokes under pressure.

Analysis of existing research on choking under pressure, coupled with understanding the cognitive processes involved, opens up the possibility for a more specific approach on the matter. The distraction theory and explicit monitoring theory offers a broad explanation. These theories discuss how worry and anxiety may alter performance as either a distraction or as a sign of overthinking due to self-consciousness. Identifying specific individual differences is crucial to understanding the underlying factors involved with choking. Beilock (2010) discusses how one's level of self- awareness may ultimately be a predictor of likeliness to choke. Some hypothesize that the more self-conscious an individual is, the less prone he or she is to choking under pressure, due to familiarity with performing under the hyperattention that pressure induces (Heaton and Sigall, 1991). Conversely, Beilock (2010) theorized that more self-consciousness is associated with an individual's tendency to overthink, which is a major reason for choking according to both explicit monitoring and distraction theories. More research is needed to improve understanding of self-awareness and self-consciousness as predictors of choking under pressure.

The present study adds to the research on how an individual's body awareness may affect performance under conditions of pressure. Although there is research on self-reported self-awareness (Masters, Eves, and Maxwell, 2005), no studies have analyzed the physical element of body awareness relative to performance failure under pressure. We used Tong, et al.'s (2013) method of Two-Point Orientation Discrimination to measure tactile stimulation perception, and the survey developed by Master, et al. (2005) to determine participants' self-reported body awareness. In sum, we examined whether body awareness would lead to more "choking" under pressure in the context of a golf-putting task.

Method

Participants

Participants were 54 undergraduate students recruited from the human subject pool system at South Dakota State University. Students received partial research credit for participation in the study. The sample consisted of 17 males and 37 females between the ages of 18 to 37. Left-handed participants were not included in analyses because of the lack of suitable equipment for left-handed people during the experiment (i.e. we did not have a left-handed putter). The analyses below are based on 16 males and 34 females.

Materials

The Movement Specific Reinvestment Scale (Masters, et al., 2005) was used to evaluate body awareness as a preliminary measure in the human subject pool system. To ensure random assignment, participants were split into one of the two conditions using a random numbers generator. Before running the participants through the procedure, they were asked to fill out a participant interview questionnaire to collect demographic information for evaluation later on. During testing, electronic calipers were used to measure tactile stimulation perception on each participant's palm and forearm. For the performance portion of the experiment, we used a small rollout putting green, golf – sized wiffle ball, and golf putter in the lab area.

Procedure

Participants completed the body awareness survey as part of the human subject pool system prescreen. After arriving in the lab for the experiment portion of the study, participants were given an informed consent form and asked to fill out a participant interview questionnaire. Next, they were asked to sit at the table across from the researcher with their arm placed palm up in a partially opened box. The researcher then used electronic calipers to complete the tactile testing portion of the research. The calipers points were set at a distance of 10 mm apart and pressed lightly against each participant's skin. During each trial, the researcher indented the calipers once parallel and once perpendicular on the skin and asked participants to indicate the order in which they perceived the set of points. If a participant reported the point orientations in the correct order, it was marked as "correct;" if answered incorrectly, it was marked as "incorrect." The researcher completed 20 trials on each participant's palm followed by 20 trials on the forearm.

After participants completed the two-point orientation discrimination trials, they were guided to the golf-putting green to complete the second phase of the study. Participants were instructed to perform 22 golf putts, with the first two putts as practice. To induce pressure in the experimental group, the researcher pretended to record their putting with a cell phone. Furthermore, two mirrors were placed near the putting green so participants could see themselves during the putting task. One mirror was at the end of the green, and the other in front of the spot where participants stood. The control group completed the same number of tactile discrimination trials and putting procedure, but without the added pressures of the mirrors and the recording device.

Results

We used analysis of covariance (ANCOVA) to examine the effect of pressure and body awareness on performance, controlling for self-reported golfing ability. Body awareness data was separated using a tercile split to evaluate participants with the lowest body awareness and those with the highest body awareness. The covariate golfing ability was significantly related to total putts made, $F(1,24) = 5.98$, p =. 022, $h_p^2 = .20$. Neither the main effects of pressure ($F(1,24) = .39$, $p = .54$, $h_p^2 = .02$) nor body awareness ($F(1,24) = 2.67$, p=.116, $h_p^2 = .100$) were statistically significant. However, there was a significant interaction between pressure and body awareness. ($F(1,24) = 5.46$, p = .03, $h_p^2 = .19$; Figure 1). Those with low body awareness made more putts in the no-pressure condition (*M* = 14.14, *SD* = 1.22) than in the pressure condition (*M* = 12.00, *SD* = 3.56). We also found that participants with high body awareness made fewer putts in the no-pressure condition (*M* = 10.60, *SD* = 1.67) than in the pressure condition (*M* = 13.00, *SD* = 3.40; Table 1).

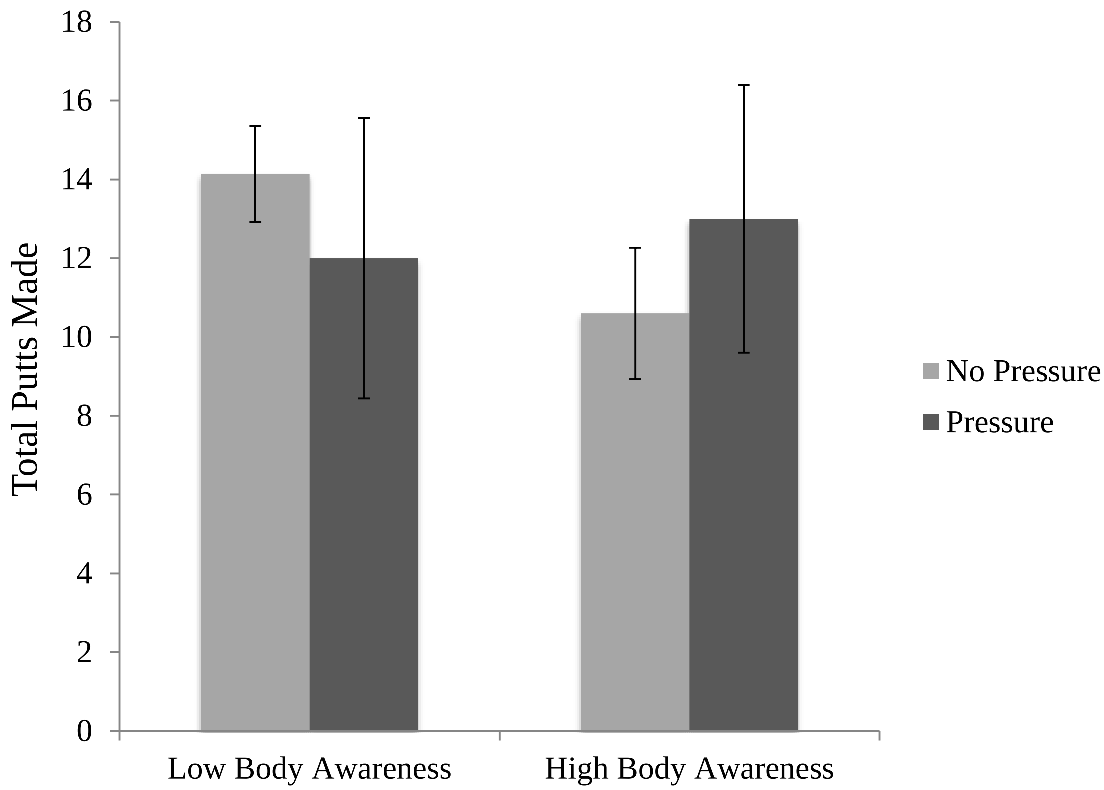

Figure 1. Total number of putts made by Body Awareness group and Pressure condition. Error bars indicate standard deviation.

Table 1. LParticipants with high body awareness mad fewer putts in the no-pressure condition than in the pressure condition.

	Low Body Awareness (n=14)	High Body Awareness (n=15)
No Pressure	14.14 (1.22)	10.60 (1.67)
Pressure	12.00 (3.56)	13.00 (3.4)

Note. Numbers in parentheses indicate standard deviation.

Discussion

The goal of this research was to examine the connection between body awareness and performance under pressure. Our results did not support the hypothesis that higher body awareness would lead participants to choke under pressure. In fact, our results suggest the opposite. That is, participants in the low body-awareness category were negatively affected by the pressure condition whereas participants in the high body-awareness category excelled under pressure (relative to the no-pressure conditions for each body-awareness category). There was a significant interaction between individual pressure and body awareness. Participant performance was possibly explained through individual body awareness in combination with the condition group. Golfing ability was taken into account by using an ANCOVA to control for the variable's relationship with performance. Participants' reported golfing ability seemed to be accurate.

One major limitation to consider with this research is the lack of participants for the pressure group because of the amount of people's data we had to eliminate. Data were thrown out if the participant was left-handed, because the golfing equipment was not suitable for this population. This, combined with randomly assigning participants, resulted in an uneven distribution of participants across conditions. Another notable limitation is the quality of the putting green provided to the participants. The green did not lay completely straight and the hole was a small circle with a slight ledge to keep the ball in. Participants may have made more putts with better equipment.

A theory proposed by Eysenck and Calvo (1992), known as the Processing Efficiency Theory, could explain the results of this experiment. This theory suggests that a little bit of pressure could be beneficial for some individuals, because it creates just enough anxiety for an individual to add an extra amount of importance and effort to the task. Processing Efficiency could explain why the high body awareness group performed slightly better in the pressure condition than in the no-pressure condition. The Yerkes-Dodson Law (1908) similarly explains how some pressure can be beneficial to performance. This law places an individual's performances on a bell curve focusing on the amount of pressure applied. Again, this law supports the idea that pressure is good up to a certain point, after which performance decreases. These theories support the conclusion that the present study did not include enough pressure to have a significant negative influence on performance. Further research on this topic should include significantly more pressure to reveal true differences in participant performance.

References

Baumeister, R. F. (1984). "Choking under pressure: self-consciousness and paradoxical effects of incentives on skillful performance." *Journal of personality and social psychology, 46*(3), 610-620.

Beilock, S. (2010). *Choke:* [what the secrets of the brain reveal about getting it right when you have to] (1st Free Press hardcover ed.). New York: Free Press.

Beilock, S. L., and Carr, T. H. (2001). On the fragility of skilled performance: What governs choking under pressure?. *Journal of experimental psychology: General*, *130*(4), 701.

Beilock, S. L., Kulp, C. A., Holt, L. E., and Carr, T. H. (2004). More on the fragility of performance: choking under pressure in mathematical problem solving. *Journal of Experimental Psychology: General*, *133*(4), 584.

Beilock, S. L., and Gray, R. (2012). From attentional control to attentional spillover: A skill-level investigation of attention, movement, and performance outcomes. *Human Movement Science*, *31*(6), 1473-1499. doi:10.1016/j.humov.2012.02.014

Eysenck, M. W., and Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. *Cognition & Emotion*, *6*(6), 409-434.

Gray, R. (2004). Attending to the execution of a complex sensorimotor skill: expertise differences, choking, and slumps. *Journal of Experimental Psychology: Applied*, *10*(1), 42.

Heaton, A.W., and Sigall, H. (1991). Self-Consciousness, self-presentation, and performance under pressure: Who chokes, and when? *Journal of Applied Social Psychology, 21(3)*, 175-188.

Lee, T. G., and Grafton, S. T. (2015). Out of control: Diminished prefrontal activity coincides with impaired motor performance due to choking under pressure. *Neuroimage*, *105*145-155. doi:10.1016/j.neuroimage.2014.10.058

Lewis, B. P., and Linder, D. E. (1997). Thinking about choking? Attentional processes and paradoxical performance. *Personality and Social Psychology Bulletin*, *23*(9), 937-944.

Masters, R. S. (1992). Knowledge, knerves and know- how: The role of explicit versus implicit knowledge in the breakdown of a complex motor skill under pressure. *British journal of psychology*, *83*(3), 343-358.

Masters, R. S. W., Eves, F. F., and Maxwell, J. P. (2005). Development of a movement specific Reinvestment Scale. In T. Morris, P. Terry, S. Gordon, S. Hanrahan, L. Ievleva, G. Kolt & T. P. (Eds.), *Proceedings of the ISSP 11th World Congress of Sport Psychology*. Sydney, Australia.

Schmidt, R. A. Motor control and learning: A behavioral emphasis. 1982. *Human Kinetics, Champaign, IL*.

Tong, J., Mao, O., and Goldreich, D. (2013). Two-Point orientation discrimination versus the traditional two-point test for tactile spatial acuity assessment. *Frontiers in Human Neuroscience*, *7*, 579. http://doi.org/10.3389/fnhum.2013.00579

Wine, J. (1971). Test anxiety and direction of attention. *Psychological bulletin, 76*(2), 92.

Yerkes, R. M. and Dodson, J. D. (1908). The relation of strength of stimulus rapidity of habit formation. *J Comp Neural Psychology*, *18,* 459-482.