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Choking vs. Clutch Performance: A Study of Sport Performance Under Pressure

Mark Otten
California State University, Northridge

Choking research in sport has suggested that an athlete's tendency to choke, versus give a *better* than usual (i.e., "clutch") performance depends on his or her personality, as well as on situational influences, such as a reliance on explicit (versus implicit) knowledge when pressured. The current study integrated these hypotheses and tested a structural equation model (SEM) to predict sport performance under pressure. Two hundred and one participants attempted two sets of 15 basketball free throws, and were videotaped during their second set of shots as a manipulation of pressure. Results of the model suggest that "reinvesting" attention in the task leads to greater anxiety (cognitive and somatic), which then predicts a higher level of self-focus; self-focus, then, did *not* lead to improved performance under pressure, whereas feelings of self-reported "perceived control" *did* help performance. Implications for measurement of these constructs, and their relationships with performance, are discussed.

Keywords: sport confidence, reinvestment, anxiety, implicit knowledge, perceived control, structural equation modeling

What inspires, or impairs, performance under pressure? Baumeister (1984) defined *pressure* as "any factor or combination of factors that increases the importance of performing well," and *choking* as any performance "decrement," or inferior performance under pressure circumstances (p. 610). By offering video gamers a free game at a shopping mall arcade for performing successfully, Baumeister (1984) induced choking under pressure; later, Lewis and Linder (1997) induced choking in a group of novice student golf putters by offering them extra experimental credit for success. In recent literature, much has been made of competing theories to explain the phenomenon of choking (e.g., Wilson, Chattington, Marple-Horvat, & Smith, 2007; Gucciardi & Dimmock, 2008).

For sports fans, such a pattern of performing below your best while under pressure may invoke memories of, say, Greg Norman blowing big leads in golf's major championships. However, for every example of an athlete choking in modern sports, there seem to be many more examples of *clutch* performers. Take Jerry West for example, who was known as "Mr. Clutch" in basketball in the 1960s and 1970s, or Tiger Woods, whose great focus and determination under

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The author is with the Psychology Department, California State University, Northridge, CA.

pressure is well known today. Indeed, consistent with theory from Baumeister and Showers (1986) and evidence from Hardy and Parfitt (1991) and Hardy (1997), it seems that some athletes not only tend *not* to choke, but actually tend to perform *better* than usual under pressure. To balance Baumeister's (1984) definition of *choking* under pressure, we define a *clutch* performance here as any performance *increment* or *superior* performance that occurs under pressure circumstances.

Are there personality differences or situational influences to explain why the athletes described above, say, have had such different reactions to pressure situations? The purpose of the current study is to bring together current theories of choking to investigate this question, and to test a model to predict successful performance under pressure in sport. A summary of hypotheses is shown in Figure 1 and explained below.

Replicating results from Masters (1992), Hardy et al. (1996) showed that a reliance on explicit knowledge of a task makes an athlete more vulnerable to choking under pressure. As defined by Reber (1993), *explicit knowledge* is knowledge of a skill that is rule based, available to consciousness, and verbalizable. Implicit learning, on the other hand, is "the acquisition of knowledge that takes place largely independently of conscious attempts to learn" (Reber, 1993, p. 5). Building upon this definition, Seger (1994) described implicit knowledge as

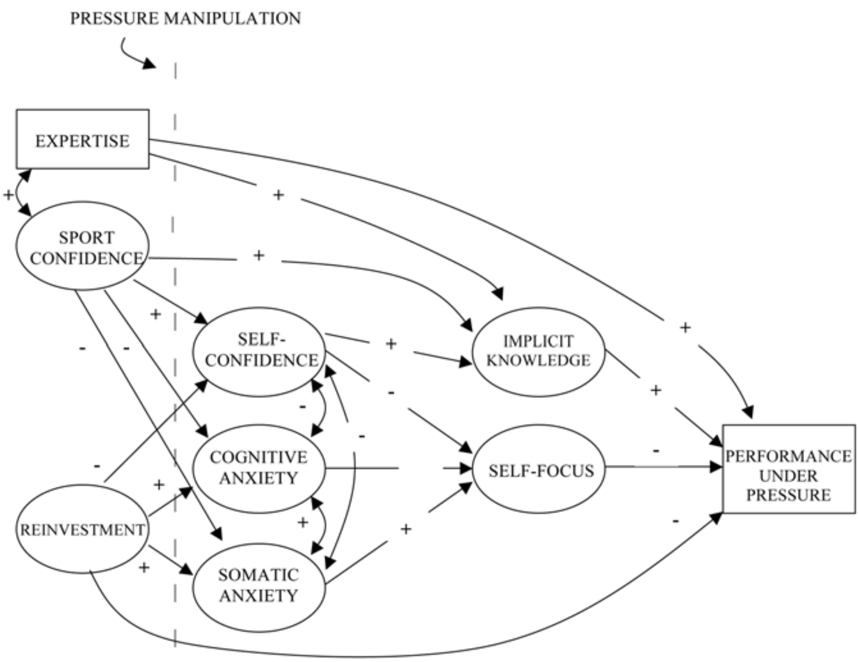

Figure 1 — Hypothesized structural equation model to predict sport performance under pressure. Ovals indicate proposed latent variables (factors). Rectangles indicate proposed measured variables. Straight arrows represent regressions. Pluses and minuses indicate predicted direction (positive or negative) of regression coefficients.

having three distinct response modalities: conceptual fluency, efficiency, and prediction/control. *Prediction/control*, operationally defined here as "perceived control" (see Results), is knowledge derived from accurate prediction of subsequent stimuli, or the ability to control the values of variables (Seger, 1994). The prediction/control modality has been identified as important for contingent probability learning tasks (e.g., Millward & Reber, 1972), as well as in dynamic systems learning (e.g., Berry & Broadbent, 1984).

Participants in the Hardy et al. (1996) study, all novices, were either given specific instructions (explicit learning) or not (implicit learning) on how to putt a golf ball. Implicit learners were required to call out random letters during the task, which served to divert attention away from the mechanics of putting. As Masters (1992) had found, when later exposed to pressure, implicit learners improved significantly over practice trials whereas the explicit learners (who had shown continuous improvement in practice) suddenly stopped improving. These results lead us to believe that a reliance on implicit, as opposed to explicit, knowledge is important for successful performance under pressure.

Such results are consistent with skill-focus, or *explicit monitoring,* theories of performance under pressure, as termed by Beilock and Carr (2001) to explain choking under pressure. As the theory explains, pressure raises anxiety about performing correctly, which increases an athlete's attention to skill processes and their step-by-step control (Beilock & Carr, 2001). By extension, if an athlete has implicit knowledge of a skill, or perceives control over it, then the athlete will focus less on these step-by-step processes, and be more likely to succeed under pressure.

Turning to relevant personality and individual difference variables, Masters, Polman, and Hammond (1993) defined the act of *reinvestment* as "purposefully endeavoring to run a skill with explicitly available knowledge of it," by "reinvesting" actions and percepts with attention (p. 655). Believing that some athletes are more likely to reinvest than others, Masters et al. (1993) developed the 20-item Reinvestment Scale, and found that among separate samples of novice golf putters and expert squash and tennis players, a *lower* score on the scale was associated with improved performance under pressure. Evidence from Jackson, Ashford, and Norsworthy (2006) supports this finding among a sample of skilled field hockey and soccer players. In addition, research from Roger and Jamieson (1988) suggests that individuals who tend to mentally rehearse emotional events (one aspect of the Reinvestment Scale) experience slower heart rate recovery after a stressful event. Thus, we use reinvestment here as (1) a positive predictor of anxiety and (2) a direct negative predictor of performance. As such, anxiety is predicted to partially mediate the relationship between reinvestment and performance.

We note here, following recommendations by Cox, Martens, and Russell (2003), that anxiety is represented in the hypothesized model by three factors (somatic and cognitive anxiety, and self-confidence; see Figure 1). Thus, all current hypotheses pertaining to anxiety are split into three parts; for example, we predict that reinvestment will be positively related to (1) somatic anxiety and (2) cognitive anxiety, and negatively related to (3) self-confidence.

Sport confidence has also been linked to performance in numerous studies (e.g., Curry & Maniar, 2003; Psychountaki & Zervas, 2000). Theory from Baumeister and Showers (1986), however, suggests that an athlete's belief in herself or himself is particularly crucial when there is pressure. According to the theory, negative “efficacy expectancies” (see Bandura, 1977) are believed to induce poor performance by way of effort withdrawal, whereas positive expectancies may counterbalance the debilitating effects of stress (Baumeister & Showers, 1986). Accordingly, we predict here that an athlete with higher levels of sport confidence will feel less anxiety when under pressure.

An athlete’s general level of expertise in his or her sport has also been linked to successful performance under pressure in sport, by way of a reliance on implicit knowledge. Evidence suggests that experts tend to rely more on implicit knowledge of a skill, while novices rely more on their explicit knowledge (e.g., Beilock, Carr, MacMahon, & Starkes, 2002; Gray, 2004). As a result, experts are more prone to choking under pressure when they focus on the explicit processes of a skill (e.g., Beilock & Carr, 2001). Thus, the current model calls for experts to perform better than novices under pressure, and for this relationship to be partially mediated by the use of implicit knowledge. That is, we predict that experts will rely more on implicit knowledge under pressure, which will then in turn lead to better performance. We also expect expertise (operationalized here by self-reported number of years of basketball-playing experience) and sport confidence to be positively correlated. Then, in what serves to extend the above theory regarding confidence when under pressure in sport (Baumeister & Showers, 1986), we predict sport confidence to have a similar, positive relationship with implicit knowledge (see Figure 1).

Finally, to explain the relationship between anxiety and performance, Liao and Masters (2002) found (1) a positive correlation between anxiety and self-focused attention, and (2) a negative correlation between self-focus and performance. That is, self-focus fully mediated the pathway from anxiety to performance. Liao and Masters (2002) achieved this result by a manipulation of self-focus; a full-body mirror was placed below the basket, such that novice basketball players were forced to see themselves while shooting free throws. Additional, recent evidence (Vickers & Williams, 2007) supports the notion that choking under pressure is exacerbated when an athlete focuses too much *internally*.

The addition of self-focus completes the proposed model of sport performance under pressure (see Figure 1).

Method

Participants

Two hundred forty-three participants from undergraduate psychology classes at the University of California, Los Angeles (UCLA), responded to an online advertisement, for the purpose of receiving extra course credit. The advertisement stipulated, “some basketball experience is preferred (but not required).” As it turned out, the group averaged 6.95 years of basketball-playing experience (SD = 4.40 years); 77 participants (32% of the sample) reported having played high school basketball in the past (either junior varsity or varsity). The sample consisted of 90 females and 153 males. The average age of participants was 20.13 years (SD = 2.44 years; range 16–36 years), and the majority (91%) of participants fell between the ages of 18 and 22. The study’s protocol was approved by the UCLA office for the protection of human subjects.

Procedure

The online advertisement was set up such that a maximum of six participants could sign up for any one time slot for the experiment, resulting in a mean number of participants per time slot of 2.26 (SD = 1.19; range 1–6). (There was no significant correlation found between the number of others present and the number of free throws participants made under pressure, $r(228) = -.002$, $p = .98$, or with their corresponding anxiety levels, $r(228) = .06$, $p = .36$.) For the first 98 participants in the study, assignment to either the experimental group or the control group was random (based on time slot). After these participants were run, an experimental manipulation check was conducted (see Results); subsequently, the control group was abandoned, and all remaining participants were run as part of the experimental group.

Institutional approval of the current protocol was obtained for this investigation. Based on this, all participants gave informed consent and then completed the following questionnaires.

Measures

An implicit knowledge questionnaire was developed for the current study based directly on Seger's (1994) definition of implicit knowledge of a skill. An exploratory factor analysis with rotation by direct oblimin (a nonorthogonal method) on this scale resulted in a two-factor solution, suggesting a first "perceived control" factor (factor label based on Items 1–3 and 7–10), and a second, more direct "implicit knowledge" factor, (factor label based on Items 4–6; see the Appendix Table, at the end of this article). By conventional standards, the second factor accounted for a relatively large 16.5% of the scale's variance and thus was retained. Items were assessed on a scale of 1 (*not at all true*) to 7 (*very true*), and administered once before shooting, and once afterward, with the latter measure modified slightly to reflect the participant's latest feelings. For example, Item 1 was modified to, "As I shot the last 15 free throws, I felt as if I was in control." For the two-factor solution, reliability was high within both the first (pretest, Cronbach's $\alpha = .85$; posttest, Cronbach's $\alpha = .85$); and second (pretest, Cronbach's $\alpha = .81$; posttest, Cronbach's $\alpha = .88$) factors. The posttest factors were then entered into the model for analysis (see Figure 1).

The Modified Sport Confidence Inventory (M-SCI) is a 22-item questionnaire developed by Vealey and Knight (2003), based on Vealey (1986). Here, the M-SCI was customized to fit the skill of basketball free throw shooting. For example, Item 5 read, "How confident are you that . . . you have the ability to improve and become more successful in basketball free throw shooting?" on a scale of 0 (*not at all confident*) to 100 (*completely confident*). Reliability among the 22 items was excellent at pretest (Cronbach's $\alpha = .97$).

The Reinvestment Scale is a 20-item questionnaire created by Masters et al. (1993). For the current study, six items were excluded because of their inclusion later on the Private Self-Consciousness Scale (PSC). A sample item read, "I'm constantly examining my motives" (*true/false*). Reliability among the 14 remaining dichotomous items was strong (Cronbach's $\alpha = .78$). Note here that items from the Reinvestment Scale were originally derived from correlates of the reinvestment construct, and not reinvestment itself; Masters et al. (1993) nonetheless treat the scale as synonymous with reinvestment.

The 17-item Competitive State Anxiety Inventory 2 (Revised) (CSAI-2R; Cox et al., 2003) was used to measure the participant's level of anxiety, both at pretest, and immediately after the pressure manipulation. Pretest reliability within each of the three factors (see Results for the three-factor solution) was high to moderate (somatic anxiety, seven items, Cronbach's $\alpha = .88$; cognitive anxiety, five items, Cronbach's $\alpha = .82$; self-confidence, seven items, Cronbach's $\alpha = .58$). Correlations between factors at pretest were as follows: somatic–cognitive anxiety, $r = .68$, $p < .001$; somatic anxiety–self-confidence, $r = -.12$, $p = .12$; cognitive anxiety–self-confidence, $r = -.28$, $p < .001$. Example items were, "I feel jittery" (somatic anxiety), "I am concerned about failing" (cognitive anxiety), and "I feel self-confident" (self-confidence), each assessed on a scale of 1 (*not at all*) to 4 (*very much so*).

The Private Self-Consciousness Scale (PSC) is a 10-item questionnaire (Fenigstein, Scheier, & Buss, 1975), used as a measure of self-focus for the current study (see Liao & Masters, 2002). The PSC was also assessed both at pretest, and immediately after the pressure manipulation; for the second measure, items were modified slightly to reflect the participant's current feelings. For example, Item 1, "I'm always trying to figure myself out," was modified to, "I'm currently trying to figure myself out" on a scale of 0 (*extremely uncharacteristic*) to 4 (*extremely characteristic*). The second measure was then entered into the model for analysis (see Figure 1). Note that while the PSC was originally a dispositional measure, these modifications serve to convert it to a measure of state self-consciousness for the purposes of the current study. Reliability among the final nine items (with Item 2 dropped, owing to a poor factor loading) was good (Cronbach's $\alpha = .71$).

Also, note here that the PSC included a six-item overlap with the Reinvestment Scale. Theory from Masters et al. (1993) suggests that the Reinvestment Scale taps into a slightly different construct, as it includes items measuring cognitive failure, and the tendency to mentally rehearse emotional events. Thus, for analyses, the six items of the PSC were dropped from the Reinvestment Scale (thereby excluding private self-consciousness as an element of the reinvestment construct), and the two scales were treated as separate measures.

Performance was recorded once for each set of 15 free throws shot by the participant. Hardy and Parfitt's (1991) scale was used to score each free throw as follows: 5 = clean basket, 4 = rim-and-in, 3 = backboard-and-in, 2 = rim-and-out, 1 = backboard-and-out, and 0 = complete miss. Performance was then measured by adding up the participant's score on each shot, to achieve a total score on each set of free throws. A participant's total score on his or her second set of free throws served as our current assessment of performance under pressure.

Expertise was operationalized by reference to a participant's self-reported number of years of basketball-playing experience.

Of the 201 participants in the experimental group, 131 were male, and 70 were female, and the average age was 20.22 years ($SD = 2.50$ years). After completing their initial questionnaires, experimental group participants were first asked to shoot 15 free throws, one at a time, and told simply to do the best that they can (performance pretest, no pressure). Participants were allowed to shoot the ball any way they wanted, provided that they stood at or behind the free throw line, marked on the floor 15 feet away from the basketball hoop, straight away.

Two on-campus basketball facilities at UCLA were used for the experiment; hoops at each were set at a standard 10-foot height, and participants used an official NCAA indoor/outdoor men's basketball.

During the first 15 free throws, the experimenter counted aloud the number of free throws made by each participant. For example, if the participant made the first shot, the experimenter would say audibly, "one for one." Two additional researchers were present to rebound and return the participant the ball after each free throw. Any other participants in the group were instructed to stand by and wait their turn. Once everyone in the group had completed these shots, and before shooting a second set of 15 more, participants were told the following cover story:

> We are going to put some pressure on you by videotaping your performance. So first, we have this waiver for you fill out. Your group today has been preselected by Dr. Malamuth from the UCLA psychology department to be videotaped. At the end of this quarter, Dr. Malamuth will be showing the tape to her Psych 10 class as an example of how athletes perform while under pressure. More specifically, we are interested in whether your performance will get better or worse under pressure. So, before you shoot, I will remind you how many shots you made for your first 15 free throws. On the waiver, be sure to check off whether it's OK to have your performance evaluated by Psych 10 students, and whether it's OK to have your face shown on film. Then, be sure to sign and date at the bottom.

The tape was not actually shown to the class; the cover story was designed simply to enhance the pressure applied to participants. The waiver (disguised as a second consent form) was also not a real waiver, and was created solely for the purpose of enhancing the believability of the cover story. All participants agreed to sign the waiver.

Immediately after being read the cover story, participants were asked to complete the follow-up measures of anxiety and self-focus. Participants were then reminded of the videotape, and told, ". . . keep in mind that you made (__) out of 15 shots the first time around." Here, "(__)" represented the number of free throws that each individual participant made on their first set of free throws, and changed accordingly for each person based on their performance. The experimenter again counted aloud the number of free throws made by each participant while they shot their second set of 15. One researcher stood by to videotape (at an angle of about 30° from the participant, about 10 feet away from the free throw line), while the third researcher remained alongside to rebound and return the participant the ball.

Afterward, participants completed the follow-up measure of implicit knowledge. Upon completion of the experiment, participants were fully debriefed, told that their videotape would *not* actually be shown to the psychology class, and that all data would remain confidential.

Of the 42 participants in the control group, 22 were male, and 20 were female, and the average age was 19.71 years (SD = 2.10 years). The procedure for the control group unfolded in exactly the same fashion as for the experimental group, to include two sets of 15 free throws, with one exception: for their second set of 15 shots, the control group was *not* told a cover story, and was *not* videotaped.

Rather than receiving the cover story, control group participants proceeded straight to the follow-up anxiety and self-focus questionnaires.

Analyses

Analyses were performed using SPSS (Version 11.0); the EQS structural equations program (Bentler, 2007) was used to perform structural equation modeling (SEM), which allows one to evaluate causal hypotheses with correlational data. Goodness of fit of the SEM to the observed data was assessed with the maximum-likelihood chi-square (χ^2) statistic (at $\alpha = .05$), the comparative fit index (CFI), the root mean squared error of approximation (RMSEA) (see Preacher & MacCallum, 2003), and the standardized root mean-square residual (SRMR). The CFI ranges from 0 to 1, where values at .95 or greater are desirable; RMSEA values less than .06 and SRMR values less than .08 are indications of good model fit.

Exploratory factor analyses were run on pretest versions of the M-SCI, the Reinvestment Scale, and the current measure of implicit knowledge. The CSAI-2R (three factors, based on Cox et al., 2003) and the PSC (one factor, based on Fenigstein et al., 1975) were subjected to confirmatory factor analyses. The follow-up versions of these measures were then inserted into the SEM by way of the factor structures determined for them at pretest.

Results

Analysis 1: Manipulation Check

After 98 participants had been gathered (56 in the experimental group, and 42 in the control group), an experimental manipulation check was run. A multivariate repeated-measures analysis of variance (MANOVA) to simultaneously compare pretest to posttest means on each of the three factors of the CSAI-2R (somatic anxiety, cognitive anxiety, and self-confidence; Cox et al., 2003) within the experimental group revealed a significant difference, in the expected direction, $F(1, 55) = 10.53$, $MSE = 9.57$, $p < .001$; partial $\eta^2 = .16$. Note that with the full 201 participants included to complete the experimental group, the result of this analysis was the same, $F(1, 187) = 37.66$, $MSE = 8.74$, $p < .001$; partial $\eta^2 = .17$. A similar repeated-measures MANOVA to compare pretest to posttest means on the CSAI-2R within the control group, then, revealed *no* significant difference across the two time points, $F(1, 38) = 0.002$, $MSE = 9.82$, $p = .97$; partial $\eta^2 < .001$. For these analyses, items within each of the factors of the CSAI-2R were summed, for simplicity, to create composite, measured anxiety variables. See Table 1 for descriptive statistics for these variables.

Analysis 2: Experimental Results

Following Hardy and Parfitt's (1991) scale of basketball shooting performance, across their first 15 free throws, participants in the experimental group averaged a total score of 38.51 ($SD = 10.88$; range 0–64); on their second set of 15 shots, they averaged 41.99 ($SD = 11.09$; range 4–70). A within-subjects t test revealed a sig-

Table 1 Manipulation Check

Variables	Pretest mean (*SD*)		Posttest mean (*SD*)	
Experimental group (first $n = 56$)				
Self-confidence (R)	12.32	(3.29)	11.50	(3.73)
Cognitive anxiety	9.48	(3.13)	9.98	(3.44)
Somatic anxiety	10.12	(3.31)	11.98	(4.04)
Experimental group (all $n = 201$)				
Self-confidence (R)	12.63	(3.36)	11.92	(3.57)
Cognitive anxiety	9.84	(3.35)	10.54	(3.89)
Somatic anxiety	10.41	(3.62)	12.24	(4.46)
Control group ($n = 42$)				
Self-confidence (R)	12.79	(3.23)	12.36	(3.92)
Cognitive anxiety	9.72	(4.05)	9.54	(3.31)
Somatic anxiety	10.38	(4.61)	10.18	(4.52)

Note. (R) = reverse-scored.

nificant difference between these two means, such that participants performed better, on average, while under pressure, $t(200) = 6.12$, $p < .001$; Cohen's $d = .43$. In all, 128 of these participants gave improved (*clutch*) performances under pressure, 60 participants were worse (*choked*) under pressure, and 13 performed identically from pre- to posttest ($M = 3.48$, $SD = 8.07$ for pretest to posttest change). Note that a within-subjects t test then revealed a similar, significant difference for the control group, on performance between their first ($M = 37.13$, $SD = 10.61$) and second ($M = 40.67$, $SD = 11.41$) sets of free throws, $t(39) = 3.37$, $p < .001$; Cohen's $d = .53$.

Analysis 3: SEM

With factor solutions included as part of the SEM, a large number of parameters were to be estimated concurrently; thus, item parceling was used for several factors (see Kishton & Widaman, 1994). Item parceling divides a scale into subsets of items; the items from each subset are then averaged together to form composite "parcels." Table 2 reflects the full solution, with each factor listed above its corresponding parcels.

The SEM was run for the experimental sample of 201 participants only (since the control group participants did not receive the pressure manipulation), with no missing data. Analyses revealed no significant departures from univariate normality for any measured variable within the model. A look at each participant's Mahalanobis distance and contribution to multivariate kurtosis revealed no extreme divergence from multivariate normality either. Thus, all 201 participants were retained. A test of fit for the SEM was rejected, $\chi^2_{301} = 506.50$, $p < .001$; however, fit statistics suggested the model fit the data well (CFI = .95; RMSEA = .06; SRMR = .08).

Table 2 Summary Statistics and Factor Loadings for the Full SEM

Variables	Mean	(*SD*)	Factor Loading
Personality Variables			
Sport Confidence			
Sport Conf. 1	67.67	(16.97)	.98
Sport Conf. 2	67.27	(16.77)	.96
Sport Conf. 3	65.58	(16.58)	.99
Reinvestment			
PSC 1	0.59	(0.33)	.46
PSC 2	0.65	(0.31)	.44
Rehearsal 1	0.33	(0.30)	.79
Rehearsal 2	0.46	(0.31)	.73
Expertise	6.97	(4.38)	—
Situational Variables			
Self-Confidence			
Perform well	2.41	(0.85)	.85
Self-Conf. 2	2.51	(0.75)	.92
Self-Conf. 3	2.30	(0.13)	.86
Cognitive Anxiety			
Concerned about failing	2.01	(0.93)	.85
Cognitive 2	2.09	(0.80)	.86
Cognitive 3	2.13	(0.88)	.89
Somatic Anxiety			
Somatic 1	1.76	(0.72)	.89
Somatic 2	1.82	(0.66)	.88
Somatic 3	1.67	(0.68)	.90
Perceived Control			
Perceived 1	4.24	(1.23)	.75
Perceived 2	4.35	(1.49)	.87
Perceived 3	4.53	(1.29)	.90
Implicit Knowledge			
Unconscious	4.01	(1.60)	.88
Cannot describe	3.65	(1.56)	.81
Intuitive	3.88	(1.59)	.88
Self-Focus			
Focus 1	1.81	(0.90)	.94
Focus 2	1.64	(0.55)	.51
Focus 3	1.98	(0.93)	.76
Performance Under Pressure	41.99	(11.09)	—

Note. All loadings significant, $p < .05$.

Post hoc model modifications were performed next. Consistent with theory from Masters et al. (1993) and Hardy et al. (1996), the Lagrange multiplier test suggested the additions of a negative correlation between the reinvestment factor and sport confidence, and a path predicting self-confidence from expertise. The Wald test then proposed the deletion of several nonsignificant relationships between variables, including those between the somatic anxiety and self-focus factors, expertise and perceived control, and sport confidence and cognitive anxiety. Figure 2 reflects the final, modified model. Fit statistics for this model were slightly improved from those that described the original: $\chi^2_{301} = 478.88$, $p < .001$; CFI = .96; RMSEA = .05; SRMR = .06. Correlations among the final structural model's eight latent variables and two measured variables are shown in Table 3.

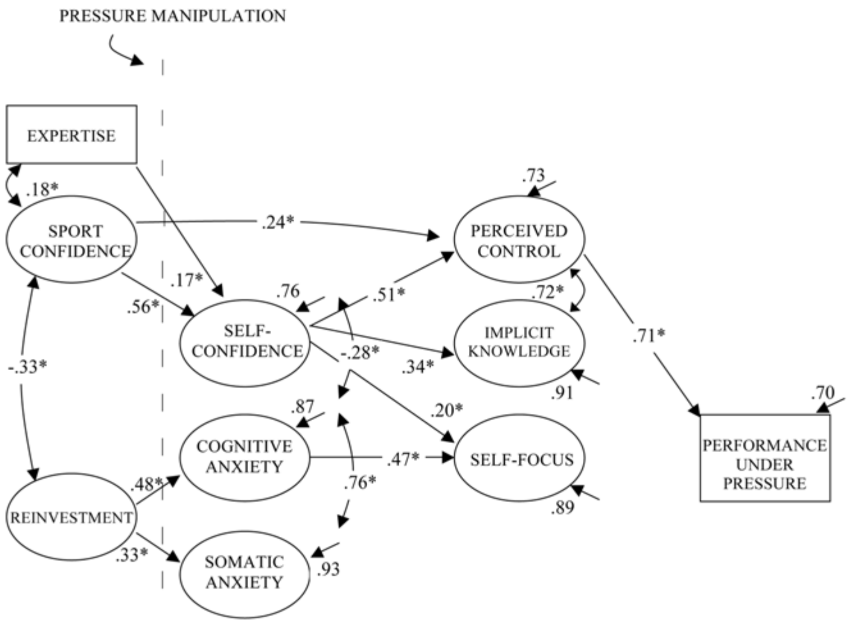

Figure 2 — Final SEM to predict sport performance under pressure, after post hoc modifications (structural model only). Ovals indicate latent variables (factors). Rectangles indicate measured variables. Straight arrows represent regressions. Straight arrows leading to dependent variables represent residual variance (error) estimates. Double arrows represent correlations. Parameter estimates are standardized regression coefficients. *$p < .05$.

Table 3 Final SEM: Correlations Among Model Constructs

	1	2	3	4	5	6	7	8	9
1. Expertise	—								
2. Sport Confidence	.18*	—							
3. Reinvestment	.00	−.33***	—						
4. Self-Confidence	.27***	.63***	−.30***	—					
5. Cognitive Anxiety	.00	−.16*	.49***	−.33***	—				
6. Somatic Anxiety	−.01	−.17*	.35***	−.23**	.79***	—			
7. Perceived Control	.18*	.56***	−.23**	.66***	−.21**	−.16*	—		
8. Implicit Knowledge	.14	.31***	−.13	.41***	−.13	−.10	.76***	—	
9. Self-Focus	.05	.05	.17*	.04	.41***	.33***	−.03	.02	—
10. Performance Under Pressure	.16*	.42***	−.24***	.49***	−.15*	−.11	.70***	.51***	.05

*$p < .05$, **$p < .01$, ***$p < .001$.

Discussion

Choking vs. Clutch

We had reason to believe that some participants would choke, and that some would give clutch performances under pressure, based on differences in situational and personality variables. So on average, we predicted *no* difference between performance means at pretest and at follow-up. In fact, results showed that experimental group participants performed *better* under pressure, on average, than at pretest; however, this result seemed to be the product of a warm-up effect, as it was present for *both* experimental and control groups. These results contrast to those for anxiety, which support the validity of our experimental manipulation. That is, experimental group participants did feel more anxiety postmanipulation than at pretest, whereas control participants did *not*.

One limitation of the experimental manipulation is acknowledged here. The effect of stating explicitly to participants, "we are going to put some pressure on you" is not well documented in the literature. It is possible, then, that the anxiety experimental participants felt was due to an awareness that they were *supposed* to feel pressure, rather than due to the experimental conditions themselves, and that subsequent self-reports of anxiety were influenced by apparent experimenter expectations (e.g., Heider, 1958). Such awareness has been shown to reduce performance deficits in the domain of stereotype threat (Johns, Schmader, & Martens, 2005); however, evidence in sport suggests that choking is more likely when it is talked about openly (Leith, 1988). With this limitation duly noted and because (as stated above) the manipulation check was successful, experimental results can be interpreted as follows.

Predicting Performance

In what serves to extend the findings of Masters (1992), our best predictor of performance under pressure was the *perceived control* factor. In the literature, the perceived control concept is best represented by the prediction/control element of Seger's (1994) of the implicit knowledge of a skill. With expertise included as part of the model, perceived control held up as the most important predictor of performance under pressure ($\beta = .71$, $p < .001$). The perceived control construct is new to the sport literature here in how it is measured, and is also relatively new both in concept and its connection here with performance under pressure (see also Cheng, Hardy, & Markland, 2009). The separate implicit knowledge factor, meanwhile, did not hold up as a direct predictor of performance under pressure. This measure may benefit from revision.

Greater sport confidence did lead to greater self-confidence, but did *not* lead to lower levels of cognitive or somatic anxiety. Such an analysis of the relationship between sport confidence and the separate dimensions that comprise performance anxiety is also relatively new to the literature (see Woodman and Hardy, 2003). Higher levels of sport confidence also led to more feelings of perceived control; thus, perceived control may be considered the mechanism by which sport confidence enhances performance when there is pressure because perceived control was in turn our best predictor of performance.

Implicit knowledge had been hypothesized to partially mediate the relationship between expertise and performance. After the split of the implicit knowledge and perceived control factors, perceived control then became a likely candidate to serve as the mediator here, by virtue of its relationship with performance. As part of the model, however, the relationships between expertise and each of these variables (perceived control, implicit knowledge, and performance), were not significant. This suggests that a reliance on implicit knowledge (or perceived control) under pressure, while important for experts (Beilock & Carr, 2001), might also be important for novices. In this case, perceived control also serves as a better predictor of success under pressure than expertise.

Consistent with Masters et al. (1993), a higher reinvestment score predicted greater cognitive and somatic anxiety under pressure. We also note that although reinvestment shared a negative bivariate correlation with performance under pressure (see Table 3), this relationship was rendered insignificant as part of the full SEM, suggesting that the link between reinvestment and performance is best explained by intervening variables, as represented in the model itself.

Contrary to Liao and Masters (2002), however, self-focus did not mediate the relationship between anxiety and performance because self-focus did not have a significant influence on performance. Self-focus did have a positive relationship with cognitive anxiety, but this relationship did not hold up as expected for the other dimensions of anxiety (somatic anxiety and self-confidence). It may be that Liao and Masters (2002) found the self-focus–performance relationship because they *manipulated* self-focus, whereas we manipulated pressure instead. To replicate a supplemental finding by Liao and Masters (2002), however, we found a significant, negative quadratic trend (implying an inverted-U relationship) between cognitive anxiety and self-focus, while treating these two variables as latent factors.

One limitation of the SEM results is noted here briefly. By conventional standards (see Ullman, 2001), our sample is small, and thus the SEM results should be interpreted with a certain level of caution. The relationships among the model's variables, particularly those of the latent variables, would profit from an empirical retesting with a larger sample.

A Revised Model

Participants in the current study differed in performance based on the situational and individual difference variables listed above; the relationship between anxiety (cognitive and somatic) and performance, however, was not significant. Indeed, perhaps explicit monitoring theories miss the point a bit, in that performance here did not depend on an anxious, or negative, reaction to pressure. Despite evidence suggesting that pressure may be facilitative to performance (Hardy, 1997, 1998; Hardy & Hutchinson, 2007), past literature has frequently assumed that an athlete will respond to pressure by becoming anxious; in turn, anxiety measures (e.g., the CSAI-2R) are often only weakly related to performance (see Craft, Magyar, Becker, & Feltz, 2003), as they are here. As such, we believe that a revised model of performance under pressure may do well to replace the *anxiety* construct with a more value-neutral *appraisal* measure.

In support of this idea, empirical work from Cerin (2003) reveals that the CSAI-2R does not convey clear information about an athlete's appraisal of a competitive event as either as a "challenge" (positive) or a "threat" (negative). Indeed, Jones, Hanton, and Swain (1994) found that elite competitive swimmers interpreted cognitive and somatic anxiety symptoms as being more facilitative to performance than nonelite swimmers did. For performance, research on social facilitation by Blascovich, Mendes, Hunter, and Salomon (1999) suggests that participants are more successful (on number and word tasks) in the presence of an audience if the task is appraised as a challenge, rather than a threat. Cheng et al. (2009) suggest that it is an individual's interpretation of physiological anxiety symptoms as positive or negative, then, that ultimately determines his or her success or failure.

According to current results, self-confidence, both in sport (trait) and state form was related to perceived control, our best predictor of performance; this pathway may approximate a positive appraisal of the pressure situation. A higher level of reinvestment predicted more anxiety, which may in turn lead to reduced feelings of perceived control; this would approximate a negative appraisal of pressure. Such a revised model may exclude the self-focus construct because it was not a significant predictor of performance here. As such, for future study, we hope current results contribute to a shift in the literature on choking, toward a more positive outlook (or at least, equal parts positive and negative).

Implications and Conclusions

Wan and Huon (2005) found that those who practiced under the presence of a video camera then performed *better* on a musical keyboard task under pressure, implying that current results may translate across performance domains. Indeed, the term *choking* has recently moved from the sport literature across to academics (see Beilock & Carr, 2005); meanwhile, research on the debilitating effects of anxiety on academic performance has a rich history, dating back to Mandler and Sarason (1952). For academic or cognition-based tasks, choking has been shown to occur because of disruptions in working memory (i.e., explicit) processes (e.g., Beilock, Kulp, Holt, & Carr, 2004; Beilock & Carr, 2005; Beilock & DeCaro, 2007; Gimmig, Huguet, Caverni, & Cury, 2006; Markman, Maddox, & Worthy, 2006). Thus, based on current results, athletes may be trained to rely on perceptions of control rather than explicit knowledge when performing, whereas students may be told the same thing for successful performance under pressure on an academic test. A caveat, however, is that findings in sport may not hold up when applied to tasks *not* involving motor skills (see Masters et al., 1993).

How might our findings inform coaches, athletes, and sport psychologists? Current findings imply 1) steering athletes away from reinvesting attention in the competitive task, to reduce performance anxiety, and 2) training athletes toward feelings of confidence and perceived control, for successful performance under pressure. In the literature, authors of one study (Liao & Masters, 2001) trained a group of table tennis to hit a topspin forehand implicitly, or "by analogy," by instructing them to swing the paddle as if following the hypotenuse of a right triangle. One other successful training method in the literature (e.g., Wan & Huon, 2005; Beilock & Carr, 2001) has been to videotape participants during practice before subjecting them to a pressure task. While this training does not specifically address our key variables for success (e.g., confidence, control), it indirectly promotes them by allowing athletes a preview of upcoming pressure conditions, thus inoculating them to the effects of anxiety.

In conclusion, we hope to contribute to the literature in sport by bringing together personality and situational factors together uniquely, as part of an SEM, to predict performance under pressure. Results of the current study may fuel further investigation of the perceived control construct, as well a more general shift in the literature to not only include choking, but also the study of *clutch* performance under pressure.

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Appendix

Implicit Knowledge (Pretest)

	Loadings	
	Factor 1 ***Perceived Control*** **(Eigenvalue = 4.49)**	**Factor 2** ***Implicit Knowledge*** **(Eigenvalue = 1.65)**
1. When I shoot basketball free throws, I feel as if I am in control.	*.76*	.06
2. When I shoot free throws, I feel I can predict the outcome of each shot.	*.54*	.17
3. When I shoot free throws, I feel I *cannot* control where the ball is going. (R)	*.67*	−.19
4. I feel I have knowledge of free throw shooting which is unconscious.	.19	*.63*
5. I have knowledge of free throw shooting which I cannot describe.	−.19	*.88*
6. I have intuitive knowledge of free throw shooting.	.17	*.72*
7. When I shoot free throws, sometimes I just *know* the ball is going to go in.	*.42*	*.35*
8. When I shoot free throws, I feel my shooting motion is automatic.	*.61*	*.30*
9. When I shoot free throws, I feel my shooting motion is *different* on each shot. (R)	*.51*	−.08
10. While I'm shooting free throws, I feel like I know what I'm doing.	*.78*	.18

Note. Eigenvalues and factor loadings for the two-factor, rotated exploratory factor solution. (R) = reverse-scored.