The Sport Psychologist, 2008, 22, 183-196

The Role of Repression in the Incidence of Ironic Errors

Tim Woodman and Paul A. Davis
Bangor University

The role of repression in the incidence of ironic errors was investigated on a golf task. Coping styles of novice golfers were determined using measures of cognitive anxiety and physiological arousal. Following baseline putts, participants ($n = 58$) performed a competition putt with the opportunity to win UK£50 (approx. US$100). Before completing the competition putt participants were instructed to "land the ball on the target, but be particularly careful not to over-shoot the target." The distance the ball traveled past the hole formed the measure of ironic effects. Probing of the coping style × condition interaction, $F(2, 41) = 6.53$, $p < .005$, revealed that only the repressors incurred a significant increase in ironic error for the competition putt. This suggests that the act of repressing anxiety has a detrimental performance effect.

When attempting to describe or explain the anxiety-performance relationship in sport, researchers typically refer to the conscious processing hypothesis (Masters, 1992), processing efficiency theory (Eysenck & Calvo, 1992), and cusp catastrophe models (Hardy, 1996), and these theoretical positions continue to attract research attention (e.g., Hardy, Beattie, & Woodman 2007; Mullen, Hardy, & Oldham 2007; Wilson, Smith, & Holmes, 2007). Conversely, the theory of ironic processes of mental control (Wegner, 1989, 1994) has received minimal research attention despite its potential applicability to sport (Janelle, 1999; Woodman & Hardy, 2001).

Developed from earlier work by Chevreul (1833), Freud (1915/1957) and Baudouin (1921), Wegner's (1989, 1994) theory of ironic processes of mental control holds that one dual-control system can result in both intentional and counter-intentional effects. Similar to other dual-functioning control systems of self-regulation (e.g., Carver & Scheier, 1990), Wegner's theory comprises two processes that work together in attempts to maintain control: These are the operating process and the monitoring process. The intentional *operating process* searches for mental contents consistent with the desired state or goal; the operating process is consciously guided and effortful. Conversely, the *monitoring process* searches for signals of failure to achieve the desired state; the monitoring process is usually unconscious, autonomous, and less demanding of mental effort (Wegner, 1994,

Woodman and Davis are with the School of Sport, Health, and Exercise Sciences, Bangor University, Gwynedd, UK.

1997). As the monitoring process identifies lapses in control, it keeps the mind sensitive to the conditions that indicate intentional control is failing. In this sense, it is adaptive; it ensures that the individual enjoys mental control. When mental load (e.g., anxiety, information-processing demands) increases, the operating process enjoys less cognitive space, and it is superseded by the monitoring process. This is what makes the monitoring process *ironic*: By keeping the mind sensitive to potential failure of the system, the monitoring process is also responsible for failure of the system.

Ironic effects have been illustrated in a number of studies (e.g., Ansfield, Wegner, & Bowser, 1996; Wegner, Ansfield, & Pilloff, 1998; Wegner, Broome, & Blumberg, 1997). Findings have consistently revealed that participants under mental load do the very thing that they are trying not to do (e.g., being happy when specifically trying not to be happy). Despite the impressive body of research in support of ironic effects (e.g., Wegner et al., 1998; Wegner, Erber, & Zanakos, 1993; Wegner, Shortt, Blake, & Page, 1990), much of this research has been conducted using laboratory-based cognitive load paradigms (e.g., holding a six-digit number in working memory), which are of limited ecological validity in sport. One aim of the current research is to test the theory using a more ecologically valid stressor.

Wegner (1989, 1994) suggested that cognitive load (i.e., information-processing demands), internal and external distractions, emotional processing, and physiological arousal will all likely increase the probability of ironic errors. When one considers the demands of sport in this context, athletes appear to be ideal candidates for the study of ironic errors. As stated previously, however, there is only very limited research on ironic errors in the sport research literature. One exception is Dugdale and Eklund's (2002) study of attention to umpires, which revealed some support for Wegner's theory in that participants reported more awareness of the umpire when explicitly instructed not to do so. Contrary to Wegner's (1994) proposal, this effect was not moderated by cognitive load. An earlier experiment by Wegner et al. (1998) revealed somewhat stronger support for the theory in a performance context. In this study, novice golfers were required "not to hit the ball past the glow spot [the target]" under mental load and under no mental load. Wegner et al. reported that participants overshot the ball significantly more when under mental load. That is, they performed in precisely the counterintentional manner when their working memory was being taxed. From an ironic process theory perspective, the increased cognitive load leads to the increased accessibility of unwanted movement thoughts ("do not hit past the target"), which in turn leads to an increased tendency toward such unwanted movement (i.e., to hit past the target); the monitoring of the unwanted movement thought ironically becomes the most accessible movement thought, which in turn leads to the unwanted movement. This position was supported in the Wegner et al. (1998) experiment (see also Beilock, Afremow, Rabe, & Carr, 2001).

In the current research, we aim to extend Wegner's theory to potential moderators of ironic performance effects. One obvious moderator is that of anxiety coping style, which has also received minimal attention in the sport psychology literature. According to Weinberger, Schwartz, and Davidson (1979), the truly low anxious person reports low anxiety and the physiological symptoms of anxiety suggest that the person is indeed low in anxiety. By contrast, although they also report low anxiety, repressors have elevated behavioral and physiological anxiety responses (Newton & Contrada, 1992; Weinberger et al., 1979; Weinstein, Averill, Opton, & Lazarus, 1968), which suggests they deny their anxiety. In this manner, there is a discrepancy between repressors' cognitive representation of anxiety and the associated behavioral and physiological symptoms (Gudjonsson, 1981).

The denial of anxiety associated with repression likely contributes to the limited amount of performance variance that has been accounted for by anxiety self-report measures (cf. Craft, Magyar, Becker, & Feltz, 2003; Woodman & Hardy, 2003). For example, Williams and Krane (1992) found that the Competitive State Anxiety Inventory-2 (Martens, Burton, Vealey, Bump, & Smith, 1990) subscales collectively predicted 5.9% of performance variance when all participants' scores were included in the analysis and 14% when repressors' scores were excluded from the analyses (see also Jerome & Williams, 2000). This is not surprising because the repressor reports low anxiety despite being anxious.

Although studies suggest that truly multidimensional measures of anxiety will likely help elucidate the anxiety-performance relationship (cf. McKay, Selig, Carlson, & Morris, 1997; Mullen, Hardy, & Tattersall, 2005; Wilson et al., 2007), much research on repression has also relied on self-report measures alone. That is, following Weinberger et al.'s (1979) influential paper, repression is conceptualized as those who report a combination of low trait anxiety and high social desirability. This is because repressors are thought to be high in defensiveness; they defend their ideal image of the nonanxious person. Although this stance has some validity (cf. Weinberger, 1990; Weinberger et al., 1979), relying on self-report measures precludes the investigation of the essence of repression; that is, the discordance between cognitive reports and behavioral and physiological indices of anxiety. As Weinberger et al. (1979) state, repressors "typically deny having elevated levels of anxiety, even though they often respond *nonverbally* (italics added) as if they were highly anxious" (p. 369). A second aim of the current investigation is to conceptualize repressors in a truly multidimensional framework, whereby their response to an anxiety-provoking situation can be measured both cognitively and physiologically.

As Weinberger and colleagues (1979) state, "repressors' defensiveness and preoccupation with avoiding awareness of anxiety may often interfere with effective coping and, paradoxically, promote behavioral and physiological responses indicative of high anxiety" (p. 370). Thus, ironically, attempts to minimize the effects of anxiety might promote the very behavioral and physiological indices of anxiety that the repressor is trying to mask. In other words, the repressor is in fact under more mental load than an individual who is anxious and simply expresses this anxiety. In the context of ironic process theory, the repressor is under more cognitive load than a truly (nonrepressive) low or high anxious person. As such, one would expect repressive individuals to suffer more from ironic errors than individuals who are either low anxious or truly high anxious. Specifically, given that (1) cognitive load has been demonstrated to lead to ironic performance errors (e.g., Wegner et al., 1998) and (2) repressors experience the cognitive load of anxiety as well as the cognitive load of repressing the expression of that anxiety (Calvo & Eysenck, 2000; Weinberger et al., 1979), we hypothesize that the magnitude of the ironic error will be greater for repressors than for other participants.

Method

Participants

Sixty-nine right-handed undergraduate sport and exercise science students (38 men, 31 women; M_{age} = 21.1 yrs; *SD* = 4.77) agreed to take part in the study. All participants provided written informed consent and background information regarding age, sex, and golf experience before commencing the study. Participants had no long-term golfing experience (48 had never played golf; 12 had played once or twice on pitch and putt; four had played once or twice on a driving range; five had played one or two rounds of golf).

Measures

Cognitive Anxiety. The Mental Readiness Form-3 (Krane, 1994) was used as the self-report measure of anxiety. The MRF-3 was developed as a less intrusive alternative to the Competitive State Anxiety Inventory-2 (CSAI-2, Martens et al., 1990). It comprises three items that are each scored on an 11-point Likert scale: cognitive anxiety from 1 (*worried*) to 11 (*not worried*), somatic anxiety from 1 (*tense*) to 11 (*not tense*), and self-confidence from 1 (*confident*) to 11 (*not confident*). Each item correlates significantly with the associated CSAI-2 subscales: cognitive anxiety (.58), somatic anxiety (.59), and self-confidence (.77). As well as being less intrusive than the CSAI-2, the MRF-3 was preferred for its use of the word "*worried*." Indeed, the CSAI-2 uses the more ambiguous term "*concern,*" whereas the essence of repression is the portrayal of the self as specifically not *worried*.

Physiological Arousal. Heart rate (HR) was measured with the use of a Pulse Tronic-Blitz heart rate monitor to provide an indication of participants' physiological responses to anxiety. Participants wore the elastic chest strap (with the transmitter) against the skin and the experimenter wore the receiver watch. This was to avoid potential interference with the task. Participants' HR was recorded while they completed the MRF-3 on two occasions: (1) before completing the baseline putts and (2) before the experimental putt. HR has been used in numerous studies as an indication of participants' physiological response to anxiety (Janelle, Singer, & Williams, 1999; Rainville, Bechara, Naqvi, & Damasio, 2006; Tremayne & Barry, 1990) and monetary incentive (Fowles, Fisher, & Tranel, 1982; Wright, Killebrew, & Pimpalapure, 2002).

Performance. We measured performance using a golf task on a flat Astroturf surface. Two white spots, 2 m apart, were painted on the surface indicating the spot where the ball was to be putt from and the target. The target was 11 cm in diameter, equivalent to the diameter of a regulation golf hole. Regulation golf balls and a standard right-handed golf putter were used throughout. Finally, we used a standard tape measure to record the distance that the ball was either underputted or overputted.

Procedure

Each participant completed the study individually in a laboratory. After participants had read and completed the informed consent form, the second author fitted the heart rate monitor. To obtain a true resting HR, we asked participants to sit quietly for at least 5 min and until heart rate reached asymptote before commencing the experimental protocol. Participants also provided background information including age, sex, and golf experience during this time.

We informed the participants: "The aim of the task is to putt the golf ball onto the target spot. Following each putt the experimenter is going to measure how far the ball is either under-putt or over-putt." After receiving the task instructions, participants completed the first MRF-3 ("Please indicate how you feel about performing the next 15 practice putts") and we recorded their HR.

After participants had completed the 15 baseline putts, we told them: "You have one final putt. This putt provides you with the opportunity to win fifty pounds sterling [£50; approximately US$100]. If you land the ball entirely or in part on the target, we will give you £50." Participants then completed the second MRF-3 ("Knowing that the next putt could win you £50 (FIFTY POUNDS), please indicate how you feel about performing the next putt") and we recorded their HR. As participants prepared for their final putt, we instructed them: "Try to land the ball on the target, but be particularly careful not to hit the ball past the target. Do not overshoot the target." Participants then completed the final putt and the experimenter recorded where the ball landed. The final putt served as the test condition.

After the final putt we answered questions, debriefed participants, and thanked them for their time. We took further contact details for payment of participants who were successful at winning the £50.

Results / Classification of Coping Styles

We used cognitive anxiety (from the MRF-3) change scores and HR change scores to operationalize participants' coping styles. Specifically, we calculated the difference between participants' cognitive anxiety at Time 1 (baseline putts) and Time 2 (experimental putt) and between participants' HR at Time 1 and Time 2. For example, a participant whose MRF-3 cognitive anxiety score was 7 at Time 1 and 5 at Time 2 would receive a cognitive anxiety change score of 2; a participant whose HR was 65 at Time 1 and 71 at Time 2 would receive a change score of 6.

Median splits were carried out on the change scores of cognitive anxiety (M_{change} = 1.22, *SD* = 2.60, Median = 1.00) and HR (M_{change} = 6.01, *SD* = 11.28, Median = 6.00). In subsequent analyses, participants with a change score greater than 1 for cognitive anxiety and greater than 6 for HR were classified as high anxious. Participants with change scores less than 1 for cognitive anxiety and less than 6 for HR were classified as low anxious. Participants with a change score greater than 1 for cognitive anxiety and less than 6 for HR were classified as defensive. Finally, those participants with change scores less than 1 for cognitive anxiety and greater than 6 for HR were classified as repressors. One outlier was identified and removed from all analyses. Final group sizes were as follows: 19 high anxious, 14 low anxious, 11 repressors, and 14 defensive participants. As we had formulated no hypotheses for the defensive group, these participants were removed from further analysis. It is worth noting here that the operationalization of these coping styles is based on participants' state anxiety and physiological arousal rather than on trait scores. We used such state scores to ensure that the measurement of participants' strategy for coping with anxiety (e.g., repression) was taken as close as possible to the measurement of performance.

Anxiety Manipulation

To ensure that the participants' cognitive anxiety change scores and HR change scores truly reflected the groups to which we had assigned them, we conducted a series of Bonferroni-corrected t tests (alpha = .008). These confirmed that: for the high anxious group, both cognitive anxiety, $t(18) = 10.65$, $p < .001$, and HR, $t(18) = 6.28$, $p < .001$, significantly increased from Time 1 to Time 2; for the low anxious group, neither cognitive anxiety, $t(13) = 2.69$, *ns*, nor HR, t(13) = .16, *ns*, significantly changed between Time 1 and Time 2; for the repressor group, cognitive anxiety did not significantly increase, $t(10) = 1.57$, ns, and HR significantly increased, $t(10) = 6.72$, $p < .001$.

The somatic anxiety and self-confidence change scores also reflected the groups to which individuals had been assigned. That is, there were no significant changes in somatic anxiety or self-confidence for the low anxious or repressor groups. Only the high anxious group significantly increased in somatic anxiety, $t(18) = 6.11$, $p < .001$, and significantly decreased in self-confidence, $t(18) = 5.41$, $p < .001$, from Time 1 (baseline) to Time 2 (Test).

The groups' descriptive statistics are presented in Table 1.

Main Analyses

Participants' first five putts served as familiarization and were not used in the analyses. The next ten putts provided the baseline measure (Time 1) and were used to compare with the performance in the experimental test condition (Time 2). A 3 (coping style: high anxiety; low anxiety; repressor) × 2 (condition: baseline putts; experimental putt) ANOVA with repeated measures on the second factor was conducted on participants' performance scores. The ANOVA revealed a significant main effect for coping style, $F(2, 41) = 3.40$, $p < .05$, $\eta^2 = .14$; a significant main effect for condition, $F(1, 41) = 7.09$, $p < .05$, $\eta^2 = .15$; and a significant coping style × condition interaction, $F(2, 41) = 6.53$, $p < .005$, $\eta^2 = .24$. The mean overputt scores for each group are presented in Table 1.

Three dependent-means t tests were performed to follow up the significant interaction. These t tests revealed no significant performance differences across conditions for either the high anxious participants, $t(18) = -1.86$, *ns*, or the low anxious participants, $t(13) = 2.11$, *ns*. The repressors, however, overputted the ball significantly more during the test condition than during the baseline condition, $t(10) = 2.54$, $p < .05$, $\eta^2 = .39$.

Table 1 Cognitive Anxiety, Somatic Anxiety, Self-Confidence, Heart Rate, and Over-Putt Error Means (*SD*) for the Three Groups Before Baseline and £50 (US$100) Putts

	Low Anxious (n = 14)		High Anxious (n = 19)		Repressor (n = 11)	
	Baseline Putts	£50* Putt	Baseline Putts	£50* Putt	Baseline Putts	£50* Putt
Cognitive anxiety	8.57 (2.17)	9.23 (1.73)	8.74 (1.85)	5.16 (1.57)	7.91 (1.97)	8.82 (1.78)
Heart rate	80.43 (9.82)	80.23 (11.30)	81.95 (14.18)	97.32 (19.21)	83.09 (9.46)	96.91 (12.34)
Somatic anxiety	7.93 (1.73)	7.14 (1.35)	7.84 (1.89)	5.16 (1.74)	7.27 (1.79)	7.82 (2.72)
Self-confidence	5.57 (2.41)	6.71 (1.82)	5.79 (1.40)	7.89 (1.52)	7.45 (2.62)	8.73 (2.15)
Over-putt error (cm)	5.80 (15.05)	29.86 (46.90)	9.51 (14.17)	–2.54 (32.79)	9.51 (12.51)	44.18 (47.92)

Note. The range of possible MRF-3 scores is: cognitive anxiety, 1 (*worried*) to 11 (*not worried*); somatic anxiety, 1 (*tense*) to 11 (*not tense*); self-confidence, 1 (*confident*) to 11 (*not confident*).

*Approx. US$100.

One participant won £50 by successfully landing the ball on the target during the £50 experimental condition and was rewarded accordingly; this participant displayed a defensive coping style.

Discussion

The results of this study lend support to Wegner's (1994, 1997) notion that cognitive load increases the likelihood of ironic errors; participants suffered significantly more from ironic performance errors in the high-anxiety experimental condition. This also corroborates the results of Wegner et al. (1998). However, the primary purpose of this study was to examine the moderating role of anxiety coping styles in the incidence of ironic errors. More specifically, we hypothesized that repressors would be particularly vulnerable to ironic errors, as their cognitive strategy to inhibit the subjective distress related to anxiety increases their cognitive load and thus makes them more prone to ironic errors. The current results support this notion, because repressors were the only group to suffer significantly from ironic performance errors.

This study is exploratory and warrants further research. First, it is important to establish the degree to which repressors engage in *effortful* attempts to mask their anxiety. In other words, do repressors deceive themselves or do they only deceive others? This is important, as one of the central foundations of Wegner's (1994) ironic process theory is that the operating process requires cognitive space. As such, cognitively effortful repression will compete with the operating process for cognitive resources. In other words, if repression is effortful and preempts cognitive resources then it is worthy of exploration in the context of ironic effects. Conversely, if the act of repression is beyond consciousness, then it will likely not compete with the operating process for cognitive space and should not disturb the operating process. The current results tend to support the former explanation rather than the latter, because the repressors were the ones to suffer from ironic effects. Although research on the relative effortful or effortless nature of repression is mixed, the act of repression demands purposeful attention away from anxiety (cf. Bonanno, Davis, Singer, & Schwartz, 1991; Derakshan & Eysenck, 1997a; Fox, 1993), and it is likely that such active avoidance demands at least some cognitive resources. That is, the repressor likely engages in elements of both self- and other-deception (Derakshan & Eysenck, 2005), and the cognitive load associated with such deception makes the repressor a potentially fruitful candidate for future research on ironic effects.

It is tempting to suggest that one should operationalize repression on the basis of the discrepancy between self-report somatic anxiety and physiological indices of anxiety rather than on the basis of discrepancies between cognitive anxiety and physiological activity. In other words, one could argue that the repressor misreads his or her physiological arousal or is simply unaware of such activity. This is especially true given that the somatic anxiety scores for both low anxious and repressor groups did not significantly change from baseline to test, which suggests that somatic anxiety might be well suited for operationalizing repression. However, such a view would be misguided for a number of reasons, in particular repressors' tendency to interpret anxiety-related physiological symptoms as reflective of excitement and challenge rather than of distress and anxiety (Derakshan & Eysenck, 1997b; Eysenck, 1997). For example, Weinberger et al. (1979) found that repressors reported less cognitive anxiety than somatic anxiety, whereas there was no such discrepancy for low and high anxious persons. The discrepancy for repressors is likely because the somatic symptom can be more easily interpreted in a positive light (e.g., increased heart rate can be interpreted as excitement) than the cognitive symptom (e.g., "I am worried") even if the physiological symptom is worry-induced (see also Derakshan & Eysenck, 1997b). Interestingly, no such interpretation differences were revealed in a recent study by Jones, Smith, and Holmes (2004). In Weinberger et al. (1979), cognitive anxiety better discriminated between coping styles (low anxious, high anxious, repressors) than somatic anxiety. Specifically, low anxious participants reported less cognitive anxiety than high anxious participants and more cognitive anxiety than repressors. In contrast, somatic anxiety did not differentiate between the repressor and low anxious groups. In light of these considerations, we believe it important to define repressors on the basis of their cognitive anxiety scores rather than their somatic anxiety scores. Further, we believe that repressors should be operationalized in a manner that is as close as possible to the definition of repression; in other words, low self-report cognitive anxiety and high physiological indices of anxiety. Cognitive anxiety is preferred to somatic anxiety for one final reason in the context of the current study. That is, the cognitive anxiety term of the MRF-3 is "*worried*," which has the advantage of capturing precisely the emotion that the repressor is attempting to mask. The somatic anxiety term "*tense*" is rather more ambiguous in this sense and thus further removed from repression.

Given that repressors form 10–20% of the general population (Myers, 2000) it is likely that the heavy reliance on self-report measures of anxiety (e.g., the CSAI-2) has somewhat limited our understanding of the anxiety-performance relationship. Ironically, although repression provides an ideal forum for understanding the likely complex interplay between physiological indices of anxiety and the self-report of such anxiety, the majority of research into repression has been based on self-report measures only. That is, the repressor is typically operationalized as an individual who scores low for anxiety (e.g., on the State Trait Anxiety Inventory; Spielberger, Gorsuch & Lushene, 1970) and high for defensiveness (e.g., on the Marlow-Crowne Social Desirability Scale; Crowne & Marlow, 1960). However, this operational definition of repression fails to capture the repressor who does not report high social desirability. In other words, the repressor who reports low anxiety and average or low levels of social desirability would not be classified as a repressor according to this definition. Physiological measures of anxiety allow one to more accurately define such individuals as repressors (Barger, Kircher, & Croyle, 1997; Newton & Contrada, 1992). A series of recent experiments that investigated the nature of the deception in repression revealed conflicting characteristics of defensiveness, where repressors display attempts to deceive both self and others (Derakshan & Eysenck, 2005). This highlights a limitation of Weinberger's (1990) purely cognitive approach to the investigation of the repressive coping style. Moreover, a number of researchers have called into question the validity of the Marlow-Crowne Social Desirability Scale in the operational definition of repression, as it was not constructed to be used as a measure of repressive coping (Jorgensen & Zachariae, 2006; Schimmack & Hartmann, 1997; Tomaka, Blascovich & Kelsey, 1992).

One of the strengths of this study was the identification of repressors through multidimensional measures assessing both cognitive anxiety and physiological arousal; this method more accurately reflects the original definition of repression by highlighting the discrepancy between reported cognitive anxiety and the associated physiological arousal. Despite this advance, future research might benefit from more sensitive measures of heart rate (e.g., heart rate variability or beat-to-beat intervals; Mullen et al., 2005; Wilson et al., 2007). Furthermore, biochemical responses to anxiety such as salivary alpha amylase or cortisol concentration (McKay et al., 1997) or skin conductance response rate (Coifman, Bonanno, Ray, & Gross, 2007) might offer more refined insight into the role of physiological arousal in repression. This is particularly true in sport where anxiety-induced heart rate is not easily differentiated from exercise- or effort-induced heart rate (Woodman & Hardy, 2001).

Novice golfers comprised the participants for this study. Consequently, the application of the present findings to elite performers is likely limited. Further, Wegner et al. (1998) reported that the effect of cognitive load on ironic errors was "somewhat more pronounced for novices than for golfers, but not significantly so" (p. 197). In fact, although they are glaringly obvious when they happen (cf. Woodman & Hardy, 2001), truly ironic errors in elite sport are likely rare events. Most expert performers likely perform very much more frequently in the manner they intended than in the manner they specifically sought to avoid. In the context of ironic process theory, this suggests that the operating and monitoring processes most often work together in harmony in the maintenance of mental control for elite performers. Experts exhibit perceptual and cognitive advantages over novices with greater pattern recognition and available attentional resources for advance cue utilization (Janelle, 1999; Williams, Ward, & Smeeton, 2004). Thus, a considerable amount of cognitive load is likely required to overwhelm the operating process and induce an ironic error, which is likely not easily replicated under laboratory conditions.

Although exploratory, the current study offers some potential implications for practitioners. First, as repressors suffered from ironic performance effects under stress and high anxious individuals did not suffer such effects, strategies that encourage disclosure for repressors would likely be beneficial (see also Strean & Strean, 1998). Such strategies would involve the athlete's acceptance of his or her feelings and the subsequent willingness to share such feelings. This would likely involve some considerable in-depth long-term work with some self-report and physiological index of anxiety. In other words, it would be no trivial task. Further, as the degree to which the repressor's deception is self-oriented or other-oriented remains unclear (Derakshan & Eysenck, 2005), advocating long-term consultancy to address the other-deception is premature at this stage.

Perhaps a more parsimonious implication from the current results (see also Wegner et al., 1998) relates to the nature of coach instruction. Indeed, when under stress, receiving an instruction not to act in a particular fashion can result in the individual performing that very action. As previously mentioned, this appears more pronounced for the novice. Thus, when providing instructions for a relatively novel task, the coach would do well to focus on verbalizing positive instructions rather than simply verbalizing the to-be-avoided action. Such instruction would likely help the performer initiate positive non-ironic instructions under stress. This seems particularly worthwhile for the repressor performer.

There are some limitations to the current research that are worth mentioning here with a view to addressing them in future. First, the median split technique is rather crude for allocating individuals to a particular group. Although the subsequent pre- to posttest analyses confirmed that the groups were meaningfully classified based upon their change scores (e.g., low anxious = no significant change in cognitive anxiety with no significant change in HR; repressors = no significant change in cognitive anxiety with a significant increase in HR), a more refined manner would be to categorize individuals on the basis of more extreme scores such as quartile splits (e.g., Derakshan & Eysenck, 1998). Such an approach would ensure more clearly distinct group classification, although it would clearly require participants in greater numbers that were evident in the current study. Second, the nature of the stressor was such that it allowed participants only one attempt at the prize (£50). We chose such a stressor to increase the ecological validity of the task. That is, the nature of sport is such that the performer often has one attempt only (e.g., soccer penalty shoot out) where the difference between failure and success on that attempt is the difference between elimination and qualification, losing and winning. This considerable gain in ecological validity comes with a considerable cost in reliability and this is further evidenced in the large performance standard deviations under stress. Despite this cost in reliability the effects are in the hypothesized direction with only repressors suffering from ironic performance effects. A challenge for future researchers, however, is to create conditions that are ripe for irony while maintaining experimental control.

In summary, the current study provides some initial support for Wegner's (1989, 1994) theory of ironic processes of mental control in the context of sport performance. Moreover, the interaction between coping style and stress condition suggests that repression should be considered as a potentially influential coping style in the incidence of ironic errors. The additional cognitive load that repressors experience when denying their anxiety appears to have been the critical amount required to overwhelm their resources and incur ironic errors. The operational definition of repression and other coping styles requires greater clarity and consistency to ensure future research is accurate in its attempts to investigate the underlying mechanisms of the anxiety-performance relationship. To this end, the use of multidimensional measurements of anxiety will likely help provide more insight into these mechanisms.

References

Ansfield, M.E., Wegner, D.M., & Bowser, R. (1996). Ironic effects of sleep urgency. *Behaviour Research and Therapy, 34,* 523–531.

Barger, S.D., Kircher, J.C., & Croyle, R.T. (1997). The effects of social context and defensiveness on the physiological responses of repressive copers. *Journal of Personality and Social Psychology, 73,* 1118–1128.

Baudoin, C. (1921). *Suggestion and autosuggestion*. New York: Dodd, Mead.

Beilock, S.L., Afremow, J.A., Rabe, A.L., & Carr, T.H. (2001). "Don't miss!" The debilitating effects of suppressive imagery on golf putting performance. *Journal of Sport and Exercise Psychology, 23,* 200–221.

Bonanno, G.A., Davis, P.J., Singer, J.L., & Schwartz, G.E. (1991). The repressor personality and avoidant information processing: A dichotic listening study. *Journal of Research in Personality, 25,* 386–401.

Calvo, M.G., & Eysenck, M.W. (2000). Early vigilance and late avoidance of threat processing: Repressive coping versus low/high anxiety. *Cognition and Emotion, 14,* 763–787.

Carver, S., & Scheier, M.F. (1990). Origins and functions of positive and negative affect: A control-process view. *Psychological Review, 97,* 19–35.

Chevreul, E. (1833). Lettre à M. Ampère sur une classe particulière de mouvements musculaires. *Revue des Deux Mondes (Paris, France: 1948), 2,* 249–257.

Coifman, K.G., Bonanno, G.A., Ray, R.D., & Gross, J.J. (2007). Does repressive coping promote resilience? Affective-autonomic response discrepancy during bereavement. *Journal of Personality and Social Psychology, 92,* 745–758.

Craft, L., Magyar, T.M., Becker, B., & Feltz, D. (2003). The relationship between the competitive state anxiety inventory-2 and sport performance: A meta-analysis. *Journal of Sport and Exercise Psychology, 25,* 44–65.

Crowne, D.P., & Marlow, D. (1960). A new scale of social desirability independent of pathology. *Journal of Consulting Psychology, 24,* 349–354.

Derakshan, N., & Eysenck, M.W. (1997a). Repression and Repressors: Theoretical and Experimental Approaches. *European Psychologist, 2,* 235–246.

Derakshan, N., & Eysenck, M.W. (1997b). Interpretive biases for one's own behavior and physiology in high-trait-anxious individuals and repressors. *Journal of Personality and Social Psychology, 52,* 155–162.

Derakshan, N., & Eysenck, M.W. (1998). Working memory capacity in high trait-anxious and repressor groups. *Cognition and Emotion, 12,* 697–713.

Derakshan, N., & Eysenck, M.W. (2005). When the bogus pipeline interferes with self-deceptive strategies: Effects on state anxiety in repressors. *Cognition and Emotion, 19,* 83–100.

Dugdale, J.R., & Eklund, R.C. (2002). Do not pay any attention to the umpires: Thought suppression and task-relevant focusing strategies. *Journal of Sport and Exercise Psychology, 24,* 306–319.

Eysenck, M.W. (1997). *Anxiety and cognition: A unified theory*. Hove, UK: Psychology Press.

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

Fowles, D., Fisher, A., & Tranel, D. (1982). The heart beats to reward: The effect of monetary incentive on heart rate. *Psychophysiology, 19,* 506–513.

Fox, E. (1993). Allocation of visual attention and anxiety. *Cognition and Emotion, 7,* 207–215.

Freud, S. (1957). Repression. In J. Strachy (Ed.), *The standard edition of the complete psychological works of Sigmund Freud* (Vol. 14, pp. 147–165). London: Hogarth Press. (Original work published 1915)

Gudjonsson, G.H. (1981). Self-reported emotional disturbance and its relation to electrodermal reactivity, defensiveness and trait anxiety. *Personality and Individual Differences, 2,* 47–52.

Hardy, L. (1996). Testing the predictions of the cusp catastrophe model of anxiety and performance. *The Sport Psychologist, 10,* 140–156.

Hardy, L., Beattie, S., & Woodman, T. (2007). Anxiety-induced performance catastrophes: Investigating effort required as an asymmetry factor. *The British Journal of Psychology, 98,* 15–31.

Hardy, L., & Fazey, J.A. (1987). The inverted-U hypothesis: A catastrophe for sport psychology? Paper presented at the Annual Conference of the North American Society for the Psychology of Sport and Physical Activity, Vancouver, Canada.

Janelle, C.M. (1999). Ironic processes in sport: Implications for the sports psychologist. *The Sport Psychologist, 13,* 201–220.

Janelle, C.M., Singer, R., & Williams, A. (1999). External distraction and attentional narrowing: Visual search evidence. *Journal of Sport and Exercise Psychology, 21,* 70–91.

Jerome, G.J., & Williams, J.M. (2000). Intensity and interpretation of competitive state anxiety: Relationship to performance and repressive coping. *Journal of Applied Sport Psychology, 12,* 236–250.

Jones, K.A., Smith, N.C., & Holmes, P.S. (2004). Anxiety symptom interpretation and performance predictions in high-anxious, low-anxious and repressor performers. *Anxiety, Stress, and Coping, 17,* 187–199.

Jorgensen, M.M., & Zachariae, R. (2006). Repressive coping style and autonomic reactions to two experimental stressors in healthy men and women. *Scandinavian Journal of Psychology, 47,* 137–148.

Krane, V. (1994). The mental readiness form as a measure of competitive state anxiety. *The Sport Psychologist, 8,* 189–202.

Martens, R., Burton, D., Vealey, R.S., Bump, L.A., & Smith, D.E. (1990). Development and validation of the Competitive State Anxiety Inventory-2. In R. Martens, R.S. Vealey, & D. Burton (Eds.), *Competitive anxiety in sport* (pp. 117–190). Champaign, IL: Human Kinetics.

Masters, R.S.W. (1992). Knowledge, nerves and know-how: The role of explicit versus implicit knowledge in the breakdown of a complex motor skill under pressure. *The British Journal of Psychology, 83,* 343–358.

McKay, J.M., Selig, S.E., Carlson, J.S., & Morris, T. (1997). Psychophysiological stress in elite golfers during practice and competition. *Australian Journal of Science and Medicine in Sport, 29,* 55–61.

Mullen, R., Hardy, L., & Oldham, A. (2007). Implicit and explicit control of motor actions: Revisiting some early evidence. *The British Journal of Psychology, 98,* 141–156.

Mullen, R., Hardy, L., & Tattersall, A. (2005). The effects of anxiety on motor performance: A test of the conscious processing hypothesis. *Journal of Sport and Exercise Psychology, 27,* 212–225.

Myers, L.B. (2000). Identifying repressors: A methodological issue for health psychology. *Psychology & Health, 15,* 205–214.

Newton, T.L., & Contrada, R.J. (1992). Repressive coping and verbal-autonomic response dissociation: The influence of social context. *Journal of Personality and Social Psychology, 62,* 159–167.

Rainville, P., Bechara, A., Naqvi, N., & Damasio, A. (2006). Basic emotions are associated with distinct patterns of cardiorespiratory activity. *International Journal of Psychophysiology, 61,* 5–18.

Schimmack, U., & Hartmann, K. (1997). Individual differences in the memory representation of emotional episodes: Exploring the cognitive processes in repression. *Journal of Personality and Social Psychology, 73,* 1064–1079.

Spielberger, C.D., Gorsuch, R.R., & Lushene, R. (1970). *The State-Trait Anxiety Inventory (STAI) test manual*. Palo Alto, CA: Consulting Psychologists Press.

Strean, W.B., & Strean, H.S. (1998). Applying psychodynamic concepts to sport psychology practice. *The Sport Psychologist, 12,* 208–222.

Tomaka, J., Blascovich, J., & Kelsey, R.M. (1992). Effects of self-deception, social desirability, and repressive coping on psychophysiological reactivity to stress. *Personality and Social Psychology Bulletin, 18,* 616–624.

Tremayne, P., & Barry, R.J. (1990). Repression of anxiety and its effects on physiological responses to stimuli in competitive gymnasts. *The Sport Psychologist, 4,* 333–352.

Wegner, D.M. (1989). *White Bears and Other Unwanted Thoughts*. New York: Viking/Penguin.

Wegner, D.M. (1994). Ironic processes of mental control. *Psychological Review, 101,* 34–52.

Wegner, D.M. (1997). When the antidote is the poison: Ironic mental control processes. *Psychological Science, 8,* 148–150.
Wegner, D.M., Ansfield, M., & Pilloff, D. (1998). The putt and the pendulum: Ironic effects of the mental control of action. *Psychological Science, 9,* 196–199.
Wegner, D.M., Broome, A., & Blumberg, S.J. (1997). Ironic effects of trying to relax under stress. *Behaviour Research and Therapy, 35,* 11–21.
Wegner, D.M., Erber, R., & Zanakos, S. (1993). Ironic processes in the mental control of mood and mood-related thought. *Journal of Personality and Social Psychology, 65,* 1093–1104.
Wegner, D.M., Shortt, J.W., Blake, A.W., & Page, M.S. (1990). The suppression of exciting thoughts. *Journal of Personality and Social Psychology, 58,* 409–418.
Weinberger, D.A. (1990). The construct validity of the repressive coping style. In J.L. Singer (Ed.), *Repression and dissociation: Implications for personality theory, psychopathology, and health*. Chicago: University of Chicago Press.
Weinberger, D.A., Schwartz, G.E., & Davidson, R.J. (1979). Low-anxious, high-anxious, and repressive coping styles: Psychometric patterns and behavioral and physiological responses to stress. *Journal of Abnormal Psychology, 88,* 369–380.
Weinstein, J., Averill, J.R., Opton, E.M., & Lazarus, R. (1968). Defensive style and discrepancy between self-report and physiological indexes of stress. *Journal of Personality and Social Psychology, 10,* 406–413.
Williams, A.M., Ward, P., & Smeeton, N.J. (2004). Perceptual and cognitive expertise in sport. In A.M. Williams and N.J. Hodge (Eds), *Skill acquisition in sport: Research, theory and practice* (328–347). London: Routledge.
Williams, J.M., & Krane, V. (1992). Coping styles and self-reported measures of state anxiety and self-confidence. *Journal of Applied Sport Psychology, 4,* 134–143.
Wilson, M., Smith, N.C., & Holmes, P.S. (2007). The role of effort in influencing the effect of anxiety on performance: Testing the conflicting predictions of processing efficiency theory and the conscious processing hypothesis. *The British Journal of Psychology, 98,* 411–428.
Woodman, T., & Hardy, L. (2001). Stress and Anxiety. In R.N. Singer, H.A. Hausenblas, & C.M. Janelle (Eds.), *The handbook of sport psychology* (pp. 290–318). New York: Wiley.
Woodman, T., & Hardy, L. (2003). The relative impact of cognitive anxiety and self-confidence upon sport performance: a meta-analysis. *Journal of Sports Sciences, 21,* 443–457.
Wright, R.A., Killebrew, K., & Pimpalapure, D. (2002). Cardiovascular incentive effects where a challenge is unfixed: Demonstrations involving social evaluation, evaluator status and monetary reward. *Psychophysiology, 39,* 188–197.

Manuscript submitted: August 2, 2007
Revision received: December 19, 2007