Conscious Processing and the Process Goal Paradox

Richard Mullen¹ and Lew Hardy²
¹University of Glamorgan; ²Bangor University

The three experiments reported here examined the process goal paradox, which has emerged from the literature on goal setting and conscious processing. We predicted that skilled but anxious performers who adopted a global movement focus using holistic process goals would outperform those who used part-oriented process goals. In line with the conscious processing hypothesis, we also predicted that performers using part process goals would experience performance impairment in test compared with baseline conditions. In all three experiments, participants performed motor tasks in baseline and test conditions. Cognitive state anxiety increased in all of the test conditions. The results confirmed our first prediction; however, we failed to find unequivocal evidence to support our second prediction. The consistent pattern of the results lends support to the suggestion that, for skilled athletes who perform under competitive pressure, using a holistic process goal that focuses attention on global aspects of a motor skill is a more effective attentional focus strategy than using a part process goal.

Keywords: anxiety, goal setting, attention

The conscious processing hypothesis (CPH; Masters, 1992) has emerged as one of a number of possible explanations for anxiety-related performance impairment in sport. Masters suggested that the performance impairment experienced by highly skilled but anxious athletes is due to the disruption of automatic task control processes. The disruption is caused by performers attempting to ensure task success by adopting a mode of conscious control primarily associated with the early stage of learning. This conscious control is based upon explicit knowledge, which is accessed in a step-by-step manner resulting in movements that are typically slow and effortful (Masters, 1992). Such controlled processing of movements contrasts with the more efficient and fluid automatic mode of functioning characteristic of experts (Schneider & Shiffrin, 1977).

Support for the CPH originated in Masters’s (1992) study, in which participants who acquired the skill of golf putting using explicit knowledge about the task subsequently experienced performance impairment when tested in a high anxiety condition. Despite several studies adding support to the CPH (Hardy, Mullen,
(Mullen, Hardy, & Oldham, 2007), several authors also noted that there is an alternative attention-based explanation of the performance impairment attributed to conscious processing (e.g., Mullen & Hardy, 2000). Specifically, the impairment could be caused by task relevant cues combining with cognitive anxiety, effectively overloading attentional capacity (see Eysenck & Calvo, 1992). Several studies have attempted to clarify the competing conscious processing and attentional explanations (Mullen & Hardy, 2000; Mullen, Hardy, & Tattersall, 2005; Wilson, Smith, & Holmes, 2007). The only unequivocal findings were reported by Mullen et al. (2005), who found support for an attentional explanation. More recently, Gucciardi and Dimmock (2008) addressed some of the limitations of Mullen and associates’ earlier studies by asking participants to use three explicit cues (coaching points) or three task-irrelevant cues (colors) while putting golf balls in low and high anxiety conditions. Under pressure, when participants putted using the three explicit cues they experienced performance impairment, offering support for a conscious processing rather than attentional effect.

The mixed pattern of results described above does little to clear up the issue of conscious processing and attentional effects as the primary causal mechanism for anxiety-related performance impairment. In addition, Mullen, Hardy, and Tattersall (2005) also noted that the performance decrements observed in their study might have been attributable to both attentional and conscious processing effects, in line with Eysenck’s (1988) suggestion that anxiety-related performance failure might be attributable to multiple causes. Consequently, it is important to establish whether using explicit task knowledge does actually cause lapses into conscious processing. To do so, there is a need to design studies that isolate conscious processing effects without invoking alternative attentional explanations. Examining the effect of process goals upon the performance of anxious individuals may offer researchers a way of achieving this objective.

Unlike outcome and performance goals, process goals specify the behaviors in which a performer will engage during performance (Kingston & Hardy, 1997); for example, a golfer might ensure that their wrists were firm during a putting stroke. As such, process goals serve an attentional cueing function enabling anxious performers to focus on salient aspects of a task, thus supporting skilled performance. Process goals have been advocated as an effective anxiety management strategy as they provide the perfect solution to Beggs’s (1990) “double-edged sword” problem. Beggs claimed that using goals to combat competitive state anxiety might actually exacerbate the problem. According to Beggs, outcome and performance goals may actually elicit negative effects if used by anxious performers because they satisfy the criteria for generating stress: they are important, require action, and may not always be achieved. Kingston, Hardy, and Markland (1992) provided preliminary evidence that process goals do in fact reduce a performer’s susceptibility to anxiety and actually enhance performance in stressful competitive situations.

Despite the initial support for process goals, several researchers have noted the apparent paradox between these positive effects and, for experts who are anxious, the potentially negative effects of an explicit focus upon task-relevant aspects of a skill (Hardy, Mullen, & Jones, 1996; Kingston & Hardy, 1997). Specifically, the CPH predicts that focusing on part of a movement using process goals that are underpinned by explicit knowledge may disrupt the normal automatic task processing of experts, leading to lapses into conscious control and subsequent performance
impairment. A possible solution to this apparent paradox involves distinguishing between different types of process goal. Process goals that are holistic or global in nature may encourage performers to conceptualize the whole of a movement. For example, “smooth” or “easy” could be used as holistic process goals for a golf putt. Such holistically focused goals may function by encouraging “chunking,” allowing the appropriate sub-actions of a movement to be generated automatically. The concept of chunking has been used to describe the automatization of cognitive skills, in which individual elements of a task are gradually incorporated into single representations, allowing smoother performance (Neves & Anderson, 1981). In terms of motor skills, MacMahon and Masters (1998) produced evidence for the chunking effect in motor skills using a serial reaction time task. MacMahon and Masters also found that, under pressure, the process of chunking reversed and the skill effectively “de-chunked.” Holistic process goals might enable skilled but anxious performers to avoid such dechunking effects, as the global focus promoted by such goals should not induce lapses into conscious processing because conscious control can only be exerted over parts of a movement. In contrast, part-focused process goals should induce conscious processing because, according to the CPH, a focus on a part of a movement using explicit knowledge about that movement by a skilled but anxious performer should encourage dechunking.

Jackson and Willson (1999) first examined the role of process goals in skill failure under pressure using “swing thoughts,” in which participants focused upon “one or two aspects of putting technique” (p. 168). However, the process goals or swing thoughts used by Jackson and Willson’s participants were a mixture of part and holistic process goals (Jackson, personal communication, 2008). More recently, Jackson, Ashford, and Norsworthy (2006) examined whether process goals impaired performance under pressure in a soccer-dribbling task. Participants used a single part process goal and the results indicated that movement-related process goals had a negative effect on dribbling performance regardless of pressure levels. A further objective of Gucciardi and Dimmock’s (2008) study described earlier was to examine the role of globally focused swing thoughts in helping participants avoid the deleterious effects of increased state anxiety. Performance in a globally focused swing thought condition was significantly better than that recorded in the task-relevant (three explicit cues) and task-irrelevant (three colors) conditions outlined earlier.

Wulf and associates have produced a large body of research that has a number of parallels with the conscious processing literature (see Wulf, 2007, for a review). Wulf and colleagues have consistently found learning advantages from adopting an external focus of attention, which involves directing a learner’s attention to the effect of an action, as opposed to an internal focus of attention that involves focusing on the body parts or movements used to produce an action. Crucially, a holistic process goal differs from an external focus as the former involves a focus on the general feeling of the movement itself, in effect an internal focus, while the latter involves a focus on an environmental effect produced by a movement.

To summarize, the mixed results reported in the aforementioned studies do little to clarify the process goal paradox. Procedural differences between the studies prevent direct comparisons; however, what is clear is that no studies to date have directly compared the efficacy of part and holistically focused process goals in high anxiety conditions. The process goal and conscious processing literature suggests that using a single, holistic movement-focused process goal will be more effective
than using a single part movement-focused process goal at preventing performance impairment under pressure. Furthermore, part process goals may also lead anxious performers to begin to consciously process task-relevant information, with concomitant negative effects on task execution. We conducted three experiments to examine these suggestions.

Experiment 1

Method

Participants. Participants consisted of 40 intermediate, club-level long jumpers (19 males and 21 females), who volunteered to take part in the study and provided informed consent. Parental consent was secured for those participants under 18 years of age. Participants were assigned to treatment conditions using stratified random assignment so that the groups were of equal ability, based on each participant’s best long jump of the season. The holistic process goal (HPG) group consisted of 9 males and 11 females, ranging in age from 16 to 20 (\(M = 17.5, \ SD = 2.21\)), with best performances ranging from 3.70 to 5.69 m (\(M = 4.65, \ SD = 0.53\)). The part process goal (PPG) group consisted of 10 males and 10 females, with ages ranging from 16 to 20 (\(M = 17.3, \ SD = 2.18\)), and best performances ranging from 3.64 to 5.4 m (\(M = 4.63, \ SD = 0.49\)).

Apparatus and Measures. Participants were tested at three similar sites. Two of the sites were equipped with an artificial rubber run-up strip, while the remaining site had a gravel-based run-up strip. All of the long jump areas were in good condition, with run-up strips and landing areas conforming to International Amateur Athletics Federation rules. In the long jump, athletes can become overly concerned with hitting the takeoff board with the correct takeoff leg within the legal boundaries. To eliminate any such anxiety effects the board was replaced with a takeoff zone. All jumps took place on dry days, when the wind velocity in the direction of the jump was less than 2 m/s. No restrictions were placed on the length of the run-up. Jumps were measured from the last point of contact of the takeoff foot in the takeoff zone to the first point of contact in the landing area. The takeoff zone was sprinkled with sand to facilitate location of the participant’s foot to ensure accurate measurement of the jumps. State anxiety was assessed using the Competitive State Anxiety Inventory-2 (CSAI-2; Martens, Burton, Vealey, Bump, & Smith, 1990). The CSAI-2 is a sport-specific, self-report inventory that has been demonstrated to be a reliable and valid measure of cognitive and somatic anxiety and self-confidence with alpha reliability coefficients ranging from .79 to .90 (Martens et al., 1990). Participants rate their anxiety symptoms on a Likert scale from 1 (not at all) to 4 (very much so). Only the cognitive anxiety subscale was used. The orienting instructions at the beginning of the CSAI-2 were modified to reflect the fact that one of the conditions was a baseline condition and the other was a competition. Adherence to goal setting conditions was assessed using a postexperimental questionnaire, which ascertained whether participants used their selected goal during performance and whether they believed that the goal had affected their performance.

Design. The experimental paradigm was adopted from Jackson and Willson (1999). The design consisted of four phases: warm-up, baseline, anxiety intervention, and
test. Participants performed three long jumps in each phase. The conditions were not counterbalanced and both groups were exposed to the test condition first. The fixed order of the conditions was imposed, as participants who were exposed to the test condition first in a pilot study that included counterbalancing revealed that they suspected a further set of test instructions would be imposed upon them during the second, baseline condition.

**Procedure.** Ethical approval for the study was obtained from the institutional ethics committee. Participants attended the testing site individually and were reminded that the purpose of the study was to examine the effect of goal setting on long jump performance. Participants were invited to generate a process goal relevant to them. In the HPG group, participants were requested to think of a global goal that encapsulated the general feeling of performing a long jump. In the PPG group, the participants were invited to think of a specific subcomponent of their long jumping technique. A list of appropriate goals was offered to the participants from which they could select a goal if they desired. All of the participants opted to choose a goal from the lists, which had been created by two British Association of Sports and Exercise Sciences (BASES)-accredited sport psychologists and a long jump coach. The selected goals were shortened to a phrase of one or two syllables, as shown in Table 1. The participants then received brief training in the use of their selected goal. Participants were asked to focus solely on their process goal by imaging the jump using the pregenerated goal and repeating the goal to themselves directly before they began their approach. Participants then performed three warm-up jumps with brief rests between each of the jumps.

Following the warm-up, participants rested for 5 min and then completed the cognitive anxiety subscale of the CSAI-2, with neutral task instructions, followed by three jumps in the low anxiety baseline condition. Participants then completed the postexperimental questionnaire. During the 5-min rest period, participants read a set of instructions informing them that they were now involved in a competition and that on the basis of their baseline jumps, they were currently lying in fourth or fifth place. A fictitious target jump was generated that fell just below their best jump from the baseline phase. The importance of the participant’s subsequent three jumps was emphasized, and they were informed that if the target jump was beaten,

<table>
<thead>
<tr>
<th>Part Process Goals</th>
<th>Part Process Goal Description</th>
<th>Holistic Process Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arch back</td>
<td>Arching the back at takeoff</td>
<td>Drive</td>
</tr>
<tr>
<td>Hips up</td>
<td>Thrusting the hips forward after takeoff</td>
<td>Thrust</td>
</tr>
<tr>
<td>Slam foot</td>
<td>Aggressive planting of foot onto takeoff area</td>
<td>Flying</td>
</tr>
<tr>
<td>Drive knee</td>
<td>Driving knee of non-takeoff leg upwards at takeoff</td>
<td>Height</td>
</tr>
<tr>
<td>Thrust hips</td>
<td>Thrusting the hips forward after takeoff</td>
<td>Reach</td>
</tr>
<tr>
<td>Throw arms</td>
<td>Throwing arms forward and upwards during flight</td>
<td>Spring</td>
</tr>
<tr>
<td>Fast knee</td>
<td>Driving knee of non-takeoff leg upwards at takeoff</td>
<td>Lift</td>
</tr>
<tr>
<td>Pull through</td>
<td>Snapping legs through into a landing position at jump apex</td>
<td></td>
</tr>
</tbody>
</table>
they would be placed in the top three of the competition and that they could win a monetary prize of £10, £8, or £6 for first, second, or third place. Participants then responded to the cognitive anxiety subscale of the CSAI-2, and completed their test jumps and then the postexperimental questionnaire. Before leaving the testing venue, participants were thanked for their participation, debriefed about the true purpose of the experiment, and awarded any prize money they were owed.

**Results**

The performance and CSAI-2 scores were analyzed using mixed two-factor analysis of variance (ANOVA; 2 × 2, Group × Anxiety Condition, with repeated measures on the second factor), and Tukey’s post hoc tests. Cognitive state anxiety increased from 22.1 (SD = 5.98) to 25.5 (SD = 5.86) in the part process goal group, and from 23 (SD = 5.06) to 25.5 (SD = 4.70) in the holistic process goal group from the baseline to test conditions. ANOVA provided no evidence of a significant Group × Anxiety Condition interaction, $F(1, 38) = .21, p > .05, \eta^2_p = .005$, or main effect for Group, $F(1, 38) = .04, p > .05, \eta^2_p = .001$. The main effect for Anxiety Condition was significant, $F(1, 38) = 10.92, p < .05, \eta^2_p = .22$, indicating that participants in both groups experienced elevated cognitive anxiety in the test condition.

In terms of long jumping performance, ANOVA revealed a significant Group × Anxiety Condition interaction, $F(1, 38) = 4.61, p < .05, \eta^2_p = .11$. Tukey’s pairwise comparisons indicated that the holistic process goal group significantly outperformed the part process goal group in the test condition; see Figure 1. Pairwise comparisons between the baseline and test conditions for both process goal groups indicated no significant changes in performance. Neither of the main effects was significant, $F(1, 38) = .24, p > .05, \eta^2_p = .006$, and $F(1, 38) = 1.34, p > .05, \eta^2_p = .03$, for Anxiety Condition and Group, respectively. Results from the postexperimental

![Figure 1](attachment:image.png) — Mean (± SE) long jump scores.
questionnaire revealed that in the holistic process goal group a single participant failed to use their chosen goal before every jump. A different participant from the same group also indicated that they believed that their selected goal did not affect their performance. In the part process goal group, 100% of participants responded positively to both questions. The data were examined with and without the problem participants with identical results. Data from all participants are reported here.

Discussion

Our prediction regarding the utility of holistic process goals was supported, as the HPG group outperformed the PPG group at test. The results were supportive of the data produced by Gucciardi and Dimmock that demonstrated the superiority of global swing thoughts compared with explicit cues. However, in contrast to Gucciardi and Dimmock’s findings, the PPG group appeared to experience no significant performance impairment. The results also contrast with those of Jackson, Ashford and Norsworthy (2006), who demonstrated that process goals directly related to skilled dribbling of a soccer ball could be detrimental to performance.

The absence of performance impairment at test in the part process goal group might be due to the criterion task adopted in Experiment 1. Long jumping is a serial motor skill, during which participants use gross body movements to achieve their goal. Conscious processing effects may be more evident in tasks that require finer motor control, for example, basketball free throws (Liao & Masters, 2002). Another possibility relates to the intermediate expertise level of the participants, who were selected as we predicted that the anxiety intervention would not be powerful enough to affect the performance of more experienced athletes. Consequently, the athletes’ skills may not have been sufficiently automated for the part process goals to impair their performance. Finally, the participants were only given relatively brief training in the use of their selected process goals and it is possible that the participants may have reverted to using their prefabricated mental set when they performed under the pressure of the competitive conditions. However, the results from the postexperimental questionnaire would not appear to support this suggestion.

Experiment 2

Experiment 2 was designed to reexamine the hypotheses underlying Experiment 1 using a different type of motor skill, the basketball free throw. Participants also received more extensive training in the use of process goals to guard against the possibility that skilled participants would revert to using their prefabricated mental set to guide their performance. We also used a group of participants with a more homogenous ability range compared with the participants in Experiment 1.

Method

Participants. With the consent of the head coach, players in the female basketball squad of a British university were asked to participate in the study. Twenty players volunteered and were assigned to treatment conditions using stratified random assignment based on a pretest of their basketball free throw shooting ability. Participants in the holistic process goal group were between 19 and 24 years of age
(M = 21.4, SD = 1.86), whereas those in the part process goal group were between 19 and 28 years of age, (M = 20.15, SD = 2.05). The participants provided informed consent before beginning the experiment.

**Apparatus and Measures.** A standard basketball and basketball court conforming to International Basketball Federation regulations were used for all testing. Basketball shooting performance was measured using a scoring system designed by Hardy and Parfitt (1991). Participants scored 5 points for a clean, successful shot, 4 points for a successful shot that rebounded in off the rim of the ring, 3 points for a successful shot that rebounded off the backboard, 2 points for an unsuccessful shot that hit the rim of the basket, 1 point for a shot that hit the backboard and missed, and 0 points for a complete miss. The test-retest-retest reliability of the five shot test was R = .58, higher than the value of r = .54 reported by Hardy and Parfitt. Anxiety was measured using the cognitive anxiety subscale of the CSAI-2, which was modified as described in Experiment 1. The effectiveness of the process goal training was assessed using a questionnaire designed specifically for this experiment. Participants were asked whether they specifically thought about their goal during practice, whether they found their goal useful, and how effective they believed their goal was in helping their performance. Participants responded using a 4-point Likert scale and a total score was calculated for each participant. Adherence to goal setting conditions was measured using the same postexperimental questionnaire as Experiment 1.

**Design.** Data collection took place on two separate occasions, once in normal practice (baseline) conditions and once in a test condition designed to increase competitive state anxiety. Participants performed five shots in each session. In contrast to Experiment 1, pilot testing did not reveal the same concerns for participants regarding the possibility of test instructions being presented in a second condition. As a result, we decided to counterbalance across experiments and expose participants in Experiment 2 to the test condition first.

**Procedure.** Ethical approval for the study was obtained from the institutional ethics committee.

**Goal Setting Selection and Instruction.** Before process goal selection and training began, the participants attended the laboratory individually where they were told that the purpose of the experiment was to examine the effects of different goal setting conditions on basketball shooting performance. The participants performed 20 warm-up free throws before completing 5 further throws, which were used to assign the participants to either a part or holistic process goal condition. One week later, participants received a single 30-min training session in the use of their selected process goal. During the training session, each participant selected their process goal from master lists prepared by a basketball coach and two BASES-accredited sport psychologists, as shown in Table 2. As in Experiment 1, it was emphasized that the holistic process goals should be conceptualized as the general feeling of the shooting action as a whole and not to specific body parts or parts of the movement. Participants then performed 20 practice shots using their personal process goal. Participants were asked to focus solely on their process goal by imaging the free throw using their pregenerated goal and repeating the goal to themselves directly before they took their shot. Following the 20 practice shots, participants completed
the training questionnaire. For each of the following 5 d, participants were asked to take 20 practice shots using their selected process goal. The practice throws on the fifth day were completed at the testing venue, following which participants completed the training questionnaire for a second time.

**Test Phase.** The day after their final practice, participants performed in the test condition. Participants performed 20 practice shots to eliminate warm-up effects (Hardy & Parfitt, 1991). Anxiety was then invoked by telling the participants that their performance was being videoed and assessed by the university coach. The free throw shots were also performed in front of a group of spectators. Participants then completed the CSAI-2 followed by their five test shots.

One week later, the participants attended the sports hall individually, completed a further 20 warm-up shots, and then received the neutral instructions, which informed them that the free throws that they were about to complete would not be subject to any scrutiny and that their scores would be combined with those of the other participants to expand the experimenter’s database for future work. Participants then completed the CSAI-2, and performed the final five shots. Finally, the participants completed the postexperimental questionnaire, were thanked for their participation, and debriefed by the experimenter.

**Results**

The training questionnaire, performance and CSAI-2 scores were analyzed using a mixed two-factor analysis of variance (ANOVA; $2 \times 2$, Group × Anxiety Condition, with repeated measures on the second factor), and Tukey’s post hoc tests. Training questionnaire scores increased from 7.3 ($SD = 1.16$) to 9.8 ($SD = 2.15$) in the PPG group and from 7.4 ($SD = 1.42$) to 9.5 ($SD = 1.43$) in the HPG group. ANOVA confirmed that the main effect for Condition was significant, $F(1, 18) = 29.12, p < .001, \eta_p^2 = .62$, indicating that participants in both groups believed that they were able to use their selected process goals more effectively. Neither the main effect for Group nor the Group × Anxiety Condition interaction were significant, $F(1, 18) < 1, p > .05, \eta_p^2 < 0.1$, and $F(1, 18) < 1, p > .05, \eta_p^2 = .07$, respectively. The postexperimental questionnaire confirmed that all of the participants in both groups believed that they had used their selected goal during performance. In addition, all of the HPG group and all but one of the PPG group indicated that they also believed that their goal affected their performance. As in Experiment 1, the data were examined

<table>
<thead>
<tr>
<th>Part Process Goals</th>
<th>Part Process Goal Description</th>
<th>Holistic Process Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fingers</td>
<td>Push fingers up and forward through the ball at release</td>
<td>Smooth</td>
</tr>
<tr>
<td>Snap</td>
<td>A focus on the snap of the wrist just before release</td>
<td>Extend</td>
</tr>
<tr>
<td>Straighten</td>
<td>Straightening of knees at the end of the shooting action</td>
<td>Soft</td>
</tr>
<tr>
<td>Toes</td>
<td>A focus on ending the shot on the toes</td>
<td>Push</td>
</tr>
<tr>
<td>Extend</td>
<td>Focus on extending the shooting arm</td>
<td>Reach</td>
</tr>
</tbody>
</table>
with and without the problem participant. There were no differences between the two analyses and the results reported here are for the full data set.

Cognitive state anxiety increased from 12.60 ($SD = 2.22$) to 20.80 ($SD = 5.10$) in the PPG group, and from 13.30 ($SD = 4.44$) to 23.00 ($SD = 5.01$) in the HPG group from the practice to test conditions. ANOVA yielded no significant Group $\times$ Anxiety Condition interaction, $F(3, 18) < 1, p > .05, \eta^2_p = .002$, or main effect for Group, $F(1, 18) < 1, p > .05, \eta^2_p = .06$. The main effect for Anxiety Condition was significant, $F(1, 18) = 75.06, p < .001, \eta^2_p = .80$, indicating that participants in both groups experienced elevated cognitive anxiety in the test condition.

For performance, Figure 2 displays the mean free-throw shooting performance scores. ANOVA confirmed that the Group $\times$ Anxiety Condition interaction was significant, $F(1, 18) = 5.10, p < .05, \eta^2_p = .21$, and Tukey’s test identified that shooting performance in the HPG group was significantly better than that of the PPG group in the high anxiety condition. There were no other significant pairwise differences. Neither of the main effects was significant.

![Figure 2 — Mean (± SE) basketball free-throw scores.](image)

**Discussion**

The aim of Experiment 2 was to examine the effect of holistic and part process goals on the shooting performance of skilled but anxious basketball players. The preexperimental process goal setting training proved effective in improving the participants’ use of process goals. As a result, we can be more confident that the participants did not revert to using a prefabricated mental set during the trials (Jackson et al., 2006). As expected, participants in both groups recorded significantly higher levels of cognitive anxiety in the test condition. The performance results obtained
also replicated those found in Experiment 1; specifically, the holistic process goal group outperformed the part process goal group at test. As in the first experiment, the conditions were not counterbalanced. Unlike Experiment 1, however, the fixed ordering of the conditions in the second experiment involved participants completing the test condition first, before the baseline condition. The fact that we obtained the same pattern of results as our first experiment would tend to support the reliability of the performance effect. One issue that is worthy of further consideration is the low number of trials completed by participants in the experimental conditions in Experiments 1 and 2: three long jumps in the first experiment and five free throws in the second. It is possible that the number of trials may have been sufficient to produce a significant performance effect at test but more trials may be required to produce significant pairwise effects between the low and high anxiety conditions.

**Experiment 3**

Experiment 3 addressed some of the issues that surrounded the first two experiments. We used the fine motor skill of golf putting, and asked participants to complete a higher number of trials in comparison with the first two experiments. Our use of experienced performers in the initial studies gave rise to some concerns regarding adherence to the goal setting interventions. Specifically, some doubts remained about the extent to which existing mental sets may have predominated in the process goal conditions. Furthermore, although highly skilled athletes are more likely to be susceptible to conscious processing effects, Linder, Lutz, Crews, and Lochbaum (1999) also demonstrated that more experience in competitive sports is related to reduced self-focus and better performance under pressure. Similarly, Beilock and Carr (2001) have shown that individuals who are accustomed to performing in pressure situations can become inoculated against the effects of pressure. To deal with these concerns, we recruited novices at the criterion task of golf putting for Experiment 3. However, previous experience in other competitive sports may potentially reduce participants’ sensitivity to experimental anxiety interventions. As a result, we also controlled for participants’ competitive experience by stratifying the random assignment based upon the number of years they had participated in competitive sport and whether this experience was at a high (international, national), or low (regional, club, or recreational) level.

With these issues in mind, the main hypotheses for the final experiment remained the same as Experiments 1 and 2. In addition to the number of golf balls holed, we used polar coordinates to assess golf putting performance. Polar coordinates are a pair of related directional measures that can provide exact information about any two locations by referencing an angle and a distance. Thus, the polar coordinates allowed independent measures of distance and directional putting error to be recorded. The polar coordinates were also used to assess the degree of adjustment made by participants from putt-to-putt. We suggest that if lapses into conscious processing occur, they will occur between putts as participants make relatively large adjustments to their putting stroke as they attempt to actively regulate their putting stroke by reinvesting explicit knowledge about the putting task. To reflect these changes, we predicted that conscious processing would also be reflected in bigger putt-to-putt adjustments.
Method

Participants. The participants were 34 novice golfers, who were all students at a British University and satisfied the criteria of having played less than five rounds of golf in their lives or who had not played golf in the last 12 months. The participants were all engaged in competitive sport, but not golf. Participants were randomly assigned to a HPG group (N = 18; 8 male, 10 female; mean age = 26.4, SD = 8.25) or a PPG group (N = 16; 5 male, 11 female; mean age = 26.5, SD = 7.43), according to the length of their participation in sport and the highest level at which the participants had competed in their main sport. In the HPG group, participants had a total of 169 years of competitive experience (M = 17.8, SD = 9.4; high level N = 3, low level N = 15) and in the PPG group, a total of 154 years competitive experience (M = 9.6, SD = 5.8; high level N = 8, low level N = 8). In the HPG group, one participant was left handed and two participants were ambidextrous, while in the PPG group there were two left handed participants. The remaining participants were right handed. The participants were given the option of putting either right or left handed. The participants provided informed consent before beginning the experiment.

Apparatus and Measures. Participants putted at a hole 10.8 cm in diameter, from a distance of 226 cm. Task difficulty was increased by requiring participants to put up a 25% incline. One standard size golf putter, which measured 88.9 cm in length, with a standard angle of lie and loft was used by all participants, in addition to standard sized white golf balls measuring 4.27 cm in diameter.

A video camera mounted on a tripod adjacent to the far end of the putting surface, directly facing the participants, was used to lead participants to believe that their putting performance was being recorded in the test condition. The camera was not set to record. The putting trials were recorded by a Casio QV-2900UX digital camera (2.1 megapixel) with a resolution set to 800 × 600 pixels for display on a computer monitor. The camera, which was attached to the ceiling directly above the hole, recorded each putt.

Cognitive state anxiety was again measured using the relevant CSAI-2 sub-scale. The number of putts successfully holed was taken as an absolute measure of performance. Polar coordinates were also used to assess the accuracy of the putts. The polar coordinates were expressed as the distance of the ball’s resting position from the start of the putt (putt distance; r), and the angle of deviation (θ) from a line drawn from the start of the putt to the center of the hole. Successful putts were therefore scored: r = 226, θ = 0. Differences between consecutive putts in terms of angular and distance error were also computed to provide an index of putt-to-putt adjustments.

Participants responded to four post experimental questions. The first two questions verified whether participants specifically thought about their goal while putting in the noncompetition and competition phases. Question 3 asked participants whether they found their process goal to be useful. Participants responded to questions 1–3 on a Likert scale from 1 (not at all) to 4 (all of the time). The last question verified that participants had not used an alternative strategy.

Procedure. Ethical approval for the study was obtained from the institutional ethics committee. The experiment consisted of six phases conducted over two
consecutive days. Phase 1 took place on Day 1, and Phases 2–6 took place on the next day.

**Day 1. Phase 1: Skill Acquisition.** During Phase 1, participants learned the golf-putting task by “discovery” (Vereijken & Whiting, 1989). The participants completed 400 putting trials in blocks of 100, with a 5-min rest between blocks (Masters, 1992). Participants then received a brief explanation of the next day’s session and the experimenter’s intention to pay them £10.

**Day 2. Phase 2: Process Goal Training.** Participants were given information to remind them what was going to happen in the second part of the experiment and about the nature and efficacy of process goals. The information served two purposes: the first was instructional and the second was to enhance participants’ commitment and motivation to use the goals as requested. As in Experiment 2, participants self-selected their respective process goal from master lists that were created from a golf coaching manual (Pelz, 2000) and approved by two BASES-accredited sport psychologists. The goals are displayed in Table 3. Participants were also allowed to devise their own goal and these were checked for suitability by the experimenter. As in Experiments 1 and 2, the experimenter emphasized that the holistic process goals should be conceptualized as the general feeling of the whole movement.

**Phase 3: Warm-up.** All of the participants were provided with the opportunity to practice using their selected process goal over 50 putts. One participant wanted to change their selected process goal part way through the warm-up and was allowed to do so.

**Phase 4: Baseline.** Following the warm-up, participants rested for 5 min. At the beginning of the fifth minute, participants were provided with neutral instructions about the next 50 putting trials. Immediately following the rest period, the participants completed the CSAI-2, and then performed 50 baseline putts, followed by a 5-min rest.

**Phase 5: Anxiety Intervention.** During the 5-min rest period, participants were provided with an instructional set informing them that they were about to take part in a golf putting challenge and that the £10 they had been offered to participate in the study could change, depending on how well they performed in the challenge.

### Table 3 Part and Holistic Process Goals Used by Participants in Experiment 3

<table>
<thead>
<tr>
<th>Part Process Goals</th>
<th>Part Process Goal Description</th>
<th>Holistic Process Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist firm</td>
<td>Keep the wrist firm throughout the putt</td>
<td>Smooth</td>
</tr>
<tr>
<td>Firm grip</td>
<td>Maintain a firm grip of the club throughout the putt</td>
<td>Pendulum</td>
</tr>
<tr>
<td>Front hands</td>
<td>Keep the hands in front of the putter blade</td>
<td>Glide</td>
</tr>
<tr>
<td>Firm through</td>
<td>Focus on a firm contact through the ball</td>
<td>Tempo</td>
</tr>
<tr>
<td>Weight to hole</td>
<td>Keep bodyweight predominantly on the foot nearest the hole</td>
<td>Push</td>
</tr>
<tr>
<td>Blade square</td>
<td>Keep the putter blade square throughout the putt</td>
<td>Through</td>
</tr>
<tr>
<td>Short back</td>
<td>Focus on a short backswing</td>
<td>Easy</td>
</tr>
</tbody>
</table>
Specifically, the participants were informed that for every putt successfully completed, they would win an extra £0.35p, but for every ball they failed to putt, £0.50p would be deducted from their £10 payment. The addition of the threat of losing money was an extension of the intervention used in the first experiment, which relied upon incentive only. The participants were also informed that a golf professional, who would view their performance on a video, would rate their putting ability. The experimenter revealed the video camera from behind some screens that the participants were told would be used to film the forthcoming putts.

**Phase 6: The Test Phase.** After reading the instructions, the participants filled in the cognitive anxiety subscale of the CSAI-2, attempted 50 putts and then completed the postexperimental questionnaire. Participants then received their competition prize money, were thanked for their participation, and debriefed about the objectives of the experiment.

**Results**

Univariate mixed two-factor ANOVAs (2 × 2; Group × Anxiety Condition, with repeated measures on the second factor) were used to examine the cognitive state anxiety response and the number of putts successfully holed. Two-factor multivariate ANOVA (MANOVA; 2 × 2, Group × Anxiety Condition, with repeated measures on the second factor) was used to examine polar coordinates (distance and angular error) and putt-to-putt adjustments (distance and angular error).

Before examining the anxiety and performance measures, the postexperimental questionnaire scores were examined to confirm that the participants had adhered to the treatment conditions. Five participants from the HPG group and two from the PPG group indicated that they did not perform as requested. Given the extensive problems revealed by the postexperimental questionnaire, these participants were removed from the final analysis. As a result, the HPG group consisted of 13 participants (8 male and 5 female) aged between 16 and 45 (∏ = 24.5, SD = 8) and the PPG group consisted of 14 participants (4 male and 10 female) aged between 18 and 50 (∏ = 27.1, SD = 7.8). The number of years competitive experience in the holistic group was 177 years (∏ = 9, SD = 9.5) and 154 years (∏ = 9.4 years, SD = 6.1 years) in the part group. In the HPG group, there was now one left-handed participant and another who was ambidextrous, who opted to putt right handed, whereas all the participants in the PPG group were right handed.

**Cognitive State Anxiety.** Mean levels of cognitive state anxiety increased from 16.08 (SD = 4.62) to 20.25 (SD = 6.51) in the HPG group and from 13.36 (SD = 2.48) to 16.64 (SD = 5.94) in the PPG group. ANOVA yielded a significant main effect for Anxiety Condition, F(1, 24) = 17.07, p < .05, η² = .42, indicating that cognitive state anxiety scores increased significantly at test. Neither the Group × Anxiety Condition interaction nor the main effect for Group were significant at p < .05, F(1, 24) < 1, η² = .01 and F(1, 24) = 3.04, η² = .11, respectively.

**Performance.** For the number of putts successfully holed, there was a significant Group × Anxiety Condition interaction, F(1, 25) = 4.24, p < .05, η² = .15 and a significant main effect for Anxiety Condition, F(1, 25) = 4.88, p < .05, η² = .16. The main effect for Group was not significant, F(1, 18) = 1, p > .05, η² = .02.
Follow-up tests on the significant interaction indicated that the HPG group scored significantly more putts than the PPG group at test, see Figure 3. This difference was caused by the significant increase in the number of putts holed by the holistic group from the baseline to test. No other pairwise differences were significant.

For the polar coordinates, the MANOVA revealed a significant Group × Anxiety Condition interaction, Wilks’s $\Lambda(2, 24) = 3.71, p < .05, \eta_p^2 = .24$. No other multivariate effects were significant. Neither of the follow up univariate ANOVAs were significant, $F(1, 25) = 2.75, p = .11, \eta_p^2 = .10$ and $F(1, 25) = 2.44, p = .13, \eta_p^2 = .09$ for angle of deviation and length of putt, respectively. Thus, it appears that the multivariate Group × Anxiety Condition interaction cannot be explained by any of the dependent variables in isolation but that a linear combination of the putting distance and angular error contributes to the significant multivariate effect (Stevens, 2002). Examination of Figures 4 and 5 suggests that for both dependent variables, the HPG group appear to outperform the PPG group in the high anxiety condition.

For the putt-to-putt adjustments, MANOVA again revealed a significant multivariate Group × Anxiety Condition interaction, Wilks’s $\Lambda(2, 24) = 4.73, p < .05, \eta_p^2 = .28$. There were no other significant multivariate effects. Follow-up univariate ANOVAs indicated that putt-to-putt adjustments in the length of the putt made no significant contribution to the multivariate effect, $F(1, 25) < 1$. The univariate test for putt-to-putt adjustments in the angle of deviation was significant, $F(1, 25) = 9.56, p < .01, \eta_p^2 = .28$; see Figure 6. Tukey’s test indicated that participants in the HPG group made smaller putt-to-putt angular adjustments at test compared with baseline. As a result, the holistic group also made significantly less angular adjustments compared with the PPG group at test. There were no other significant pairwise differences.

Figure 3 — Mean (± SE) number of putts holed.
Figure 4 — Mean (± SE) putt distance.

Figure 5 — Mean (± SE) putt angular error.
The performance results were slightly different to those found in Experiments 1 and 2. Specifically, the HPG group made significant improvements from baseline to test. As in Experiments 1 and 2, the HPG group also outperformed the PPG group at test, and the performance of the latter group once again remained stable across baseline and test conditions. In addition the inclusion of the putt-to-putt adjustments as a dependent variable helped to shed more light on the relationship between the process goal strategies and performance. The HPG group made significantly smaller putt-to-putt angular adjustments compared with the PPG group at test. This difference was brought about by the holistic group making significantly smaller adjustments at test compared with baseline.

**Figure 6** — Mean (± SE) putt-to-putt angular adjustments.

**Discussion**

The purpose of this series of experiments was to examine the CPH and the process goal paradox. Specifically, we explored the use of part and holistic oriented process goals and their effect on the execution of well-learned motor skills in anxious individuals. Using three different motor tasks, golf putting, basketball free throw shooting and long jumping, we demonstrated that, relative to task execution guided by a single part process goal, a single holistic process goal interacts with increased levels of cognitive state anxiety to help maintain or improve motor performance, while a single part process goal leads to inferior performance. The findings relating to the disruptive effect of part process goals as predicted by the CPH are less clear as, in all three studies, the anxious performance of participants who were
asked to use a single part-focused process goal did not significantly deteriorate from baseline performance levels.

The absence of any significant performance impairment at test in the part process goal conditions contrasts with much of the literature on conscious processing (Gucciardi & Dimmock, 2008; Jackson et al., 2006; Masters, 1992). One crucial difference between our studies and the recent work of Gucciardi and Dimmock is the number of goals used by participants. Gucciardi and Dimmock asked their participants to use three explicit cues, whereas we opted to use a single cue. In all of our experiments, a single cue did not significantly impair performance, although participants did not benefit from the performance advantages associated with using holistic process goals. The discrepant pattern of results between our studies and those reported by Gucciardi and Dimmock does lend support to the work of Jackson and Willson (1999) who found that a single “swing thought” related to golf putting helped prevent performance impairment. Crucially, in a second experiment, Jackson and Willson found that using four explicit cues relating to the putting stroke did disrupt the performance of anxious participants. Although speculative, it appears that conscious processing effects may be related to the number of part process goals used by participants to guide performance, once again invoking an attentionally related explanation of performance deficits (cf. Eysenck & Calvo, 1992).

Nevertheless, the most parsimonious explanation of the findings is a conscious processing explanation. If the part process goals did not activate conscious control in the high anxiety condition, why did participants in these conditions not experience the same performance benefits as participants in the holistic process goal groups? Potentially, it was possible for the PPG groups to make the same significant gains as the HPG groups. Consequently, the relative impairment of the PPG groups provides some basis for drawing the inference that such goals do cause conscious processing effects.

Our use of polar coordinates in Experiment 3 to produce independent measures of putting strength and bias, in conjunction with an outcome measure and an index of trial-to-trial variability also produced a more fine-grained examination of performance in comparison with the absolute error and target measures adopted in earlier studies examining accuracy in golf (e.g., Mullen et al., 2005; Wulf, Lauterbach & Toole, 1999). Polar coordinates allow researchers to establish whether changes in performance are due to poor control of the force or direction, or both, components of performance. We hypothesized that conscious processing effects would be associated with larger trial-to-trial variability as participants made larger alterations to their putting action using the part process goals. This suggestion was based upon research that has demonstrated that motor control associated with reduced automaticity is characterized by frozen degrees of freedom and larger amplitude body adjustments (McNevin, Shea, & Wulf, 2003; Pijpers, Oudejans, Holzheimer & Bakker, 2003). In our final experiment, we hypothesized that these changes would manifest themselves as larger putt-to-putt adjustments. The reduced trial-to-trial variability displayed by the HPG group at test provides some support for the suggestion that such goals might help performers maintain automatic control of performance (Masters, 1992).

We did find consistent support for the relative efficacy of holistic process goals over part process goals in the high anxiety test condition in all three experi-
ments, supporting the suggestions made by Hardy, Mullen, and Jones (1996) and Kingston and Hardy (1997). Our results are also in line with Gucciardi and Dimmock’s (2008) finding that global swing thoughts are more effective than using explicit cues to guide performance. However, Gucciardi and Dimmock found that holistic cues had a positive effect on performance irrespective of anxiety level, whereas we only found an advantage for holistic cues in high anxiety conditions. The mechanisms by which holistic process goals exert a beneficial effect on performance are therefore worthy of further examination. The concept of chunking (MacMahon & Masters, 1998), which parallels the work of Neves and Anderson (1981) on compilation in the acquisition of cognitive skills, may prove to be the best available explanation. Specifically, holistic process goals may allow performers to incorporate the individual subunits of a task into a single global representation, allowing the movement to run more smoothly and automatically.

Holistic process goals appear to operate in a similar way to external focus strategies (Wulf, 2007) in that they prevent a focus on the specific mechanics of a movement. One reviewer of this paper suggested that our holistic process goals actually promoted an external focus; however, the holistic process goals used in all three experiments were designed to promote a global, movement-oriented focus. The experimenter emphasized to participants that they should select a goal that, for them, best encapsulated the general feeling of the whole movement. Steps were also taken to ensure that participants fully understood the nature of the holistic process goals. In the context of Wulf’’s work, such instructions would constitute an internal focus, so we believe that the adoption of an external focus would be unlikely. A limitation of previous attentional focus research has been the absence of a check that performers did in fact direct their attention to the desired location (Beilock & Carr, 2001; Wulf, 2007). Our post experimental questionnaires confirmed that despite some problems, our participants did adopt their assigned focus. In Experiment 3, where numerous participants indicated that they did not adhere to task conditions, their data were removed from subsequent analyses. These data provide grounds for more confident assertions that our observed performance effects were the result of successful attempts to control the type of focus employed.

One could also argue that Wulf’s (2007) notion of attentional focus could provide an explanation for the absence of performance impairment for the part process goal groups if those goals incorporated both internal and external foci. However, the part process goals used in Experiments 1 and 2 were all movement-oriented and, as such, would have promoted an internal focus on the parts of the body performing the movement. The part process goals used in Experiment 3 did include both internal and external foci. “Blade square” is an example of an external focus on the putter head, while both “short back” and “firm through” could also potentially involve a focus on the putter head. However, we would argue that the use of both types of focus are not an issue in Experiment 3 as the internal-external distinction may not be applicable in golf putting as the coordination patterns required to complete a putt may not be complex enough (Poolton, Maxwell, Masters, & Raab, 2006; Wulf, 2007) Thus, Experiments 1 and 2 are not confounded by internal and external foci and although both types of focus may have been used in Experiment 3, any potential confounding is negated by the nature of the task. Nevertheless, the potential interaction between goal-type and internal-external focus should be examined in future research.
Despite our confidence that internal and external foci did not confound our goal setting conditions, different goal effects could explain the absence of performance impairment in the PPG group. Our post experimental questionnaire could have been improved by recording the specific goal that each participant used. In so doing, it would have been possible to examine the possibility that different types of part process goals might promote different kinds of attentional focus. For example, in the PPG group in Experiment 2, a distal part process focus on the fingers or wrist in the basketball free throw may have been more susceptible to anxiety effects than a more proximal part process focus on the knees or the shooting arm (cf. Beuter, Duda, & Widule, 1989). Participants may have selected primarily proximally focused part process goals, and these may have been more resistant to anxiety effects than distally focused part process goals. There may also have been goal preferences within the HPG group that a more detailed post-experimental questionnaire may have helped reveal.

On the surface, holistic process goals appear somewhat similar to the concepts of analogy (Masters, 2008) and metaphor (Butler, 1996), which have been widely used as triggers and cues in imagery routines. Both concepts can be described as “the labeling of movement components and instructions to code movement information symbolically” (Bird & Cripe, 1986, p. 204). For example, Wulf, Lauterbach and Toole (1999) found that participants who practiced a chip shot by focusing on the pendulum-like motion of the club outperformed those who adopted an internal focus. Consequently, Wulf (2007) suggested that metaphors are a useful way to induce an external focus, especially in movements where no implement or environmental object is used, for example in gymnastics or diving. However, both analogies and metaphor differ from holistic process goals as they appear to be coded symbolically; for example, the image of a pendulum used by Wulf et al., or Masters’s (2008) description of a right-handed triangle, where learners are asked to imagine bringing the racket head squarely up the hypotenuse. Holistic process goals are different as they encapsulate and describe the feeling of performing the whole movement and, as such, are kinesthetically coded and may bear more relation to kinesthetic imagery. Consequently, it could be important to establish whether movement-oriented holistic process goals are more effective at enhancing performance compared with metaphors and analogies that may promote a more external focus.

The absence of counterbalancing is a limitation of the three experiments; however, we believe that the consistent pattern of results we have reported represents strong evidence for a reliable effect that cannot be explained by order effects. In addition, although our focus was on comparing the relative efficacy of the two types of process goal, the inclusion of control conditions would add weight to our conclusion regarding the superiority of holistic process goals. One could also argue that our evidence would be stronger had we included a design that incorporated a within-subjects treatment of the process goal conditions. However, in our series of studies we felt that there was a real risk that repeated measures on the process goal conditions might confuse the participants, who would have been asked to adopt multiple process goal strategies. Where multiple treatment interference is a possibility, random assignment to separate goal conditions would appear to be the preferred design option. One way to have strengthened our findings using separate process goal conditions would have been to conduct one of our studies
using a learning paradigm, incorporating practice, retention and transfer phases, to more fully explore the process goal paradox.

In terms of practical implications, if process goals form part of a competitor’s preperformance routine then they should be holistic in nature to cope with situations where increased levels of cognitive state anxiety threaten expert performance (Boutcher, 1990; Kingston & Hardy, 1997). As Beggs (1990) noted, however, the education of performers in the use of process goals is not straightforward and consultants should consider the difficulties often encountered with regard to goal commitment, acceptance, and adherence on the part of athletes.

There is already considerable evidence supporting the efficacy of preperformance routines in preparation for task execution (Boutcher, 1990). The content of preperformance routines and the exact way that they impact upon performance have been less well researched; however, the routines usually have process-oriented goals as a central feature (Hardy, Jones, & Gould, 1996). Our results suggest that, for self-paced activities at least, the process goals used in such routines should be holistic in nature. Of course, as Hardy, Jones, and Gould have noted, process goals do not have to be problem-focused, but may be emotion focused; for example, a basketball player might have the goal of being relaxed before attempting a free throw. Our suggestions regarding practical implications should be tempered by the need to establish whether movement-oriented holistic process goals are more or less effective that the adoption of an external focus.

In conclusion, the findings of the three studies reported here confirm the importance of holistically oriented process goals in helping skilled but anxious performers avoid the potentially negative effects of focusing on components of a skill using part-oriented process goals. It also appears that using a single part process goal may not necessarily lead to conscious processing and subsequent performance impairment. Future research should focus on examining the control mechanisms that govern the effectiveness of holistic process goals, whether such goals are more effective than adopting an external focus and the extent to which our findings are generalizable across different tasks and levels of practice.

Acknowledgments

The authors would like to thank Kaline Ali and Abbi Walker for their assistance in data collection.

References


*Manuscript received: October 21, 2008
Revision accepted: November 30, 2009*