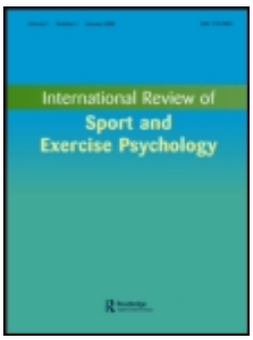

International Review of Sport and Exercise Psychology

ISSN: 1750-984X (Print) 1750-9858 (Online) Journal homepage: http://www.tandfonline.com/loi/rirs20

Pre-performance routines in sport: current understanding and future directions

Stewart Cotterill

To cite this article: Stewart Cotterill (2010) Pre-performance routines in sport: current understanding and future directions, International Review of Sport and Exercise Psychology, 3:2, 132-153, DOI: 10.1080/1750984X.2010.488269

To link to this article: https://doi.org/10.1080/1750984X.2010.488269

International Review of Sport and Exercise Psychology
Vol. 3, No. 2, September 2010, 132–153

Routledge
Taylor & Francis Group

Pre-performance routines in sport: current understanding and future directions

Stewart Cotterill*

Sport and Exercise, University of Gloucestershire, Oxstalls Campus, Oxstalls Lane, Gloucester GL2 9HW, UK

(*Received 9 April 2009; final version received 16 April 2010*)

The development of a pre-performance routine continues to be an intuitively appealing and widely accepted technique to enhance preparation for performance in sport. However, actual understanding falls somewhat short of that required to recommend with confidence the development of a pre-performance routine. At a fundamental level it is still not clear what function routines fulfil, what they should consist of or the most effective way to teach them. This review seeks to clarify current understanding and highlight areas requiring further attention. Greater understanding is required to understand the psychological components of routines as well as understanding the process through which a routine is developed/taught.

Keywords: pre-performance routines; preparation; performance; strategies

Introduction

Over the past 30 years the development and application of pre-performance routines in sport has been an area of specific interest to sport psychologists, coaches, and performers alike. Developing, understanding and enhancing the preparation for performance has been seen as a very real way of ultimately enhancing performance level and consistency. The use of this understanding to develop a consistent approach in preparing for performance has been advocated as a tool through which these higher levels of performance and consistency can be achieved. Authors such as Lidor and Tenenbaum (1993), Boutcher (1990), and Lobmeyer and Wasserman (1986) have advocated the use of structured routines prior to performance, which are believed to be an extremely important behavioural technique to help performers to attain high levels of achievement in sport. A number of definitions have been offered in the literature in an attempt to clarify what is meant by the term pre-performance routine. These range from Crampton (1989, p. 9) who referred to an 'ordered collection of thoughts and behaviours' to Foster, Weigand, and Baines (2006) who suggested that pre-performance routines involve 'cognitive and behavioural elements that intentionally help regulate arousal and concentration' (p. 167). However, the definition suggested by Moran (1996) appears to have been adopted most readily by other studies exploring the pre-performance routine phenomenon. Moran (1996) defined pre-performance routines as 'a sequence of task-relevant thoughts and actions which

*Email: scotterill@glos.ac.uk

ISSN 1750-984X print/ISSN 1750-9858 online

DOI: 10.1080/1750984X.2010.488269
http://www.informaworld.com

an athlete engages in systematically prior to his or her performance of a specific sports skill' (p. 177). This definition clearly highlights the importance of both cognitive processes and behaviours in preparation to successfully execute performance.

At this point it is important to clarify differences in the associated literature regarding terminology. Authors have tended to refer to either pre-performance routines (Cotterill, 2008; Holder, 2003; Jackson, 2001, 2003; Lonsdale & Tam, 2007; Marlow, Bull, Heath, & Shambrook, 1998; McCann, Lavallee, & Lavallee, 2001; Moran, 1996, 2004; Singer, 2002) or pre-shot routines (Cohn, Rotella, & Lloyd, 1990; Crews & Boutcher, 1986; Douglas & Fox, 2002; Gayton, Cielinski, Francis-Keniston, & Hearns, 1989; Harle & Vickers, 2001; Mack, 2001; Moore & Stevenson, 1994; Shaw, 2002). All of the references to pre-shot routines occur in studies where performance was described in terms of shots (either basketball or golf). As a result, pre-shot routines could be classified as a more sport/activity-specific description of a pre-performance routine. In the literature there is also reference to a 'mental preparation routine'. However, the definition of this routine as 'systematic, ritualized patterns of physical actions and pre-planned sequences of thoughts and arousal related cues' (Gould & Udry, 1994, p. 483) again refers to the same phenomenon described by Moran (1996) whilst defining pre-performance routines.

Although the use of pre-performance routines is more readily implemented with closed skills (such as a golf shot, basketball free throw, long jump, hockey penalty flick, etc.), they have also been examined in some open skill sports. Pre-performance routine research in sport to date has explored basketball (Czech, Ploszay, & Burke, 2004; Gayton *et al*., 1989; Hall & Erffmeyer, 1983; Harle & Vickers, 2001; Lamirandt & Rainey, 1994; Lidor, Arnon, & Bronstein, 1999; Lidor & Tenenbaum, 1993; Lobmeyer & Wasserman, 1986; Lonsdale & Tam, 2007; Mack, 2001; Predebon & Docker, 1992; Southard & Miracle, 1993; Wrisberg & Pein, 1992), bowling (Kirschenbaum, 1987; Kirschenbaum, Tomarken, & Ordman, 1982), dance (Vergeer & Hanrahan, 1998), diving (Highlen & Bennett, 1983), football (Vealey, 1988), golf (Beauchamp, Halliwell, Fournier, & Koestner, 1996; Boutcher & Crews, 1987; Cohn *et al*., 1990; Cotterill, 2008; Fairweather & Potgeiter, 1993; Kingston & Hardy, 2001; Kirschenbaum & Bale, 1980; McCann *et al*., 2001; Rotella & Bunker, 1981; Shaw, 2002; Thomas & Over, 1994; Yancey, 1977), gymnastics (Mahoney & Avener, 1977; Schack, 1997), rugby union (Jackson, 2003; Jackson & Baker, 2001), skiing and skating (Orlick, 1986), tennis (Moore, 1986), volleyball (Lidor & Mayan, 2005), track and field athletics (Cotterill & Greenlees, 2003), water polo (Marlow *et al.*, 1998), and wrestling (Gould, Weiss, & Weinberg, 1981). This review will seek to clarify the extent of current knowledge regarding pre-performance routines, exploring the suggested impact that routines have on performance. Clarification will also be sought regarding current understanding of how the pre-performance routine actually impacts on performance, and how we can seek to measure and understand this component of performance. Finally, this article will look to review current understanding regarding the teaching and development of pre-performance routines in sport.

Impact of pre-performance routines on performance

The area relating to pre-performance routine use in sport that has received the greatest attention is the link with performance. Numerous authors have explored this link across a range of sports. A summary of the various experimental studies exploring pre-performance routines is presented in Table 1. The most popular approach has sought to test a control group's performance against that of an experimental group, which has been taught and practised a pre-performance routine. Hall and Erffmeyer (1983) in their study of 10 highly skilled female basketball players reported that visuomotor behaviour rehearsal improved free throw accuracy. This positive impact of routines in basketball was also reported by Lobmeyer and Wasserman (1986) with 43 participants, and Gayton *et al*. (1989) with 25 high school basketball players, and Wrisberg and Pein (1992) exploring success rates with and without pre-shot routines. Taking this one step further in golf, Crews and Boutcher (1986), Boutcher and Zinsser (1990) and Douglas and Fox (2002) all highlighted that better performers had more consistent routines in their behavioural composition and their temporal duration. The positive impact of routine usage on performance has also been reported by Czech *et al*. (2004) and Hill and Borden (1995). While the link between pre-performance routine usage has been widely reported, what is less clear is the function that routines actually fulfil in enhancing performance.

The function(s) that pre-performance routines fulfil

The popularity of pre-performance routine use in sport stems largely from the belief that they enable performers to concentrate more effectively. To this end, Boutcher (1992) suggested five main benefits that pre-performance routines may provide to golfers. These included: improving concentration by encouraging the golfer to focus their thoughts on the task-relevant cues; helping the golfer overcome a natural tendency to dwell on negatives; allowing the golfer to select the appropriate motor schema; preventing 'warm-up' decrements and the devotion of excessive attention to the mechanics of their automatic skill.

Numerous hypotheses have been developed to explain the roles that pre-performance routines satisfy. In particular it has been suggested that they prescribe an attentional focus (Boutcher, 1992; Czech *et al*., 2004; Harle & Vickers, 2001); reduce the impact of distractions (Boutcher & Crews, 1987; Moore & Stevenson, 1994; Weinberg, 1988); act as a trigger for well learnt movement patterns (Boutcher & Crews, 1987; Moran, 1996); divert attention from task irrelevant thoughts to task relevant thoughts (Gould & Udry, 1994; Maynard, 1998); improve concentration (Foster *et al*., 2006; Holder, 2003); enhance the recall of physiological and psychological states (Marlow *et al*., 1998); help performers achieve behavioural and temporal consistency in their performance (Wrisberg & Penn, 1992); prevent performers focusing on the mechanics of their skills and the resulting unravelling of automaticity (Beilock & Carr, 2001; Beilock, Carr, MacMahon, & Starkes, 2002); improve performance under pressure (Mesagno, Marchant, & Morris, 2008); or allow performers to evaluate conditions and calibrate their responses (Schack, 1997). Singer (2002) more generally suggested that the purpose of pre-performance routines is to 'put oneself in an optimal emotional, high self-expectant, confident, and focused state immediately prior to execution, and to remain that way during the act'

Table 1. Summary of experimental studies exploring pre-performance routines in sport.

Study	Participants	Routine conditions/ task	Results
Hall & Erffmeyer (1983)	10 female inter collegiate basketball players.	Use of visuomotor behaviour rehearsal relaxation phase, visualization of a stressful event, and performance in a simulated stressful situation.	Use of Visuomotor behaviour rehearsal enhanced free-throw performance.
Crews & Boutcher (1986)	30 undergraduates (17 male, 13 female) in a beginners golf class.	Routines included two practice swings, visualization of a line from target to the ball, setting the club next to the ball, one glance to the target, setting grip, setting feet, one more glance at the target, then executing the swing.	Trained males had higher post training scores than the control group, but this was not replicated for females.
Lobmeyer & Wasserman (1986)	University basketball players (12 male, 15 female), high school basketball players (10 male, 6 female).	2 conditions: i) normal responses and routines before each shot, ii) without preparatory routine.	Free-throw accuracy was higher for the normal condition compared to the without condition.
Crews & Boutcher (1987)	12 Lady Pro tour players.	2 routines used: i) full-swing routine (stand behind the ball, move beside the ball, setting the club behind the ball and glance at target, setting stance, three waggles and two glances at the target, execute the swing, ii) putting routine (stand behind ball, move beside ball, two practice swings, setting the club behind ball with a glance at the target, setting stance, two glances at the target, execute the shot.	All golfers very consistent in their behaviours. The more successful players had longer pre-shot routines.

Table 1 (*Continued*)

Study	Participants	Routine conditions/ task	Results
Boutcher & Crews (1987)	12 collegiate golfers (6 male, 6 female).	2 conditions: routine & control. Routines involved focusing on specific cues and actions, such as practice swings.	Both male and female routine groups significantly increased time but decreased variability.
Southard, Miracle, & Landwer (1989)	10 university basketball players.	2 contitions: i) ritual (unlimited time and freedom of movement prior to free-throw attempt, ii) non-ritual (shooting without any movements other than performing the action under a restricted time period.	Results suggested that the duration of behaviours was most important to free-throw shooting success.
Wrisberg & Anshel (1989)	40 junior athletes, male (10.2–12.4yrs).	Participants used either i) mental imagery, ii) an arousal adjustment strategy, iii) a combined imagery and arousal adjustment strategy.	Mental imagery combined with arousal adjustment enhanced free-throw performance.
Gayton *et al.* (1989)	25 male high school basketball players.	2 conditions: i) pre-shot routine (players used their normal routines), ii) no routine (shot with no preparation).	A greater number of baskets were scored in the routine condition when compared to the no routine condition.
Boutcher & Zinsser (1990)	30 golfers (15 elite, 15 beginner).	Total duration of pre-shot behaviours, duration of time club was stationary behind the ball, number of practice swings and glances at the hole were recorded.	Elite golfers had longer more complicated pre-shot behaviours, but were more consistent when compared to the beginners.
Cohn *et al.* (1990)	3 elite collegiate golfers.	Behavioural routine: alignment with target, posture, consistent ball positions. Cognitive routine: decision on, and commitment to club selection, type of shot to be played, position of the target.	No immediate improvements were recorded, however participants did feel the intervention had a positive effect on performance.

Table 1 (*Continued*)

Study	Participants	Routine conditions/ task	Results
Wrisberg & Penn (1992)	224 intermural and collegiate basketball collegiate basketball players.	The length of the pre-shot interval scores and free-throw percentages were recorded.	Higher percentage shooters maintained a higher level of temporal constancy in executing their PPRs than lower percentage shooters.
Predebon & Docker (1992)	30 baskeball players, minimum 5 years experience.	3 conditions: i) No routine (asked just to shoot with no preparation),ii) routine (asked to sight the basket, bounce the ball three times and shoot), iii) Imagery/ physical condition (asked to imagine the shot sequence first without the ball, then with the ball.	The imagery group performed the best, followed by the routine group, and the no-routine group.
Southard & Miracle (1993)	8 female university basketball players.	4 conditions: i) standard free-throw ritual, ii) maintaining the relative timing of ritual but reducing overall duration by half, iii) maintaining timing but doubling overall duration, iv) same behaviour and overall duration but relative durations were altered.	Relative timing of behaviours (rhythmicity) is more important to performance than the absolute timing of pre-performance rituals.
Hill & Borden (1995)	31 male league bowlers.	Pre-test–post-test design 2 conditions: i) control, ii) experimental who were exposed to a generic attentional cueing script, which was to be used whilst delivering the ball.	Attentional cueing group scored significantly higher than the control group.
Southard & Amos (1996)	7 male varsity sportsmen.	All participants participated in golf, basketball, and tennis rituals and performances.	Significant correlations were determined to exist between relative timing and success.

Table 1 (*Continued*)

Study	Participants	Routine conditions/ task	Results
Beauchamp *et al.* (1996)	65 junior college students on an intro golf class.	2 conditions: i) Cognitive-behavioural group (sport analysis phase, individual assessment phase, motivation phase, integration of mental skills and evaluation), ii) Physical skill group (emphasized the physical skill and mechanics of putting).	Cognitive-behavioural group demonstrated improved performance, motivation, and routine usage.
Marlow *et al.* (1998)	3 male water polo players.	Each player developed a PPR including a concentration cue, a relaxation cue, imagery cue and cue word.	Results suggested a positive change immediately following PPR introduction.
Jackson & Baker (2001)	1 elite rugby kicker.	Physical preparation time and concentration time measured. Physical prep time from when ball left the kicker's hand to the end of physical prep period, concentration time then the time from the end of physical prep time to initiation of the kick.	Both concentration time and physical prep time increased with task difficulty. A number of different psychological skills were also used to prepare.
Calmels & Fournier (2001)	12 elite female gymnasts.	2 conditions: i) execution of gymnastic floor routine, ii) rehearsal of the routine mentally only.	Mental movement time was longer than physical movement time as task difficulty increased.
Mack (2001)	17 male intercollegiate basketball players.	4 conditions: i) normal routine and duration, ii) normal routine and altered duration, iii) altered routine and normal duration, iv) altered routine and altered time.	Altering the movements had a significant effect on performance, but duration did not.

Table 1 (*Continued*)

Study	Participants	Routine conditions/ task	Results
McCann *et al.* (2001)	28 male golfers and 28 male non-golfers.	6 experimental groups both golfers and non golfers allocated to: i) no practice, ii) physical practice, iii) physical practice and a cognitive-behavioural routine.	Only significant improvements in performance for non-golfer group (iii).
Radlo, Steinberg, Singer, Barba, & Melnikov (2002)	20 male novice dart throwers.	Participants split into 2 groups: i) internal attentional focus (thinking about the feel of the dart, drawing the dart back, the bend in the elbow, the feel of the dart leaving the fingers), ii) External attentional focus (focus on the dart board, and throw the dart at the focus).	Results indicated that an external attentional strategy is associated with more ideal psychophysiological responses than an internal focus.
Jackson (2003)	20 elite rugby kickers.	Physical preparation time and concentration time measured. Physical prep time from when ball left the kicker's hand to the end of physical prep period, concentration time then the time from the end of physical prep time to initiation of the kick.	Players had longer concentration times and shorter physical prep times when scores were close, no difference between best and worse kickers on routine time, consistency or rhythmicity.
Lidor & Mayan (2005)	60 novice female volleyball players	Participants taught 2 variations of PPRs when learning to serve in volleyball: i) motor-emphasized, ii) cognitive emphasized.	Motor-emphasized learners were more accurate than cognitive-emphasized learners in retention trials.

Table 1 (*Continued*)

Study	Participants	Routine conditions/ task	Results
Foster *et al.* (2008)	22 male basketball players.	2 conditions: i) control (superstitious behaviour), ii) experimental (developed PPR consisting of a concentration cue, a relaxation cue, imagery, and a cue word).	Very little difference reported between the superstitious behaviour and PPR groups.
Lonsdale & Tam (2007)	15 pro basketball players.	Total routine duration was recorded for each free-throw. Recorded from when the player received the ball from the referee until release.	No difference based on the duration of the routine, but differences were observed depending on behavioural consistency.
Haddad & Tremayne (2009)	5 talented junior basketball players.	2 conditions: baseline and experimental. Experimental group received training in centring.	Results suggested the use of centring may be beneficial as part of the PPR.

PPR – pre-performance routine

(p. 367). Shaw (2002) also hypothesized that the value of pre-performance routines may be in that they pre-sensitize the movement system to the appropriate perception-action coupling (Williams, Davids, & Williams, 1999) between the environment and the player. Each of these suggested functions has emerged as a result of other analyses and have not themselves been the focus of investigation. For example, Boutcher (1992) suggested that pre-performance routines help by providing an attentional focus, but did not test whether the routines do actually provide an attentional focus.

Although intuitively appealing, there is not sufficient depth of research explicitly exploring and testing the function that pre-performance routines fulfil. Of the above mentioned studies most are based upon suggestions made in prior related publications (Beilock & Carr, 2001; Boutcher & Crews, 1987; Czech *et al.*, 2004; Foster *et al.*, 2006; Gould & Udry, 1994; Harle & Vickers, 2001; Holder, 2003; Shaw, 2002; Singer, 2002; Wrisberg & Penn, 1992) which in turn can be traced back to authors including Keele (1973), Nideffer (1976) and Schmidt (1988). None of these three authors explicitly explored pre-performance routines. Of the other studies that have actually explored the function of pre-performance routines, Hill and Borden (1995) reported that attentional cueing scripts aided performance and therefore should be considered a component of pre-performance preparation. Most pre-performance experimental studies have sought to explore the link between routine use and performance, but have not taken the next step to explore the mechanism

through which this occurs. As a result, further investigation is required to explore the function of the pre-performance routine. Both the coaches' and the athletes' perception of pre-performance routine function should be explored in greater detail. Experimental designs should also seek to test for evidence to support the proposed functions highlighted in earlier publications.

Components of the pre-performance routine

Behavioural characteristics

Early research exploring pre-performance routines focused heavily on the behaviours and the timing of pre-performance routines. Authors such as Crews and Boutcher (1986), Boutcher and Crews (1987), Wrisberg and Pein (1992), Southard and Miracle (1993), Southard and Amos (1996), and Cotterill and Collins (2003) sought to describe the temporal and behavioural characteristics of pre-performance routines. Initial research focused on comparing novice and elite performers or comparing successful and unsuccessful performance to ascertain if differences existed. These descriptions enhanced our understanding of the behavioural components of the routines used and either the overall duration of the routines or the duration of discrete behavioural components but the importance of this information is limited. Differences were reported, but these differences were not explained. Is the fact that expert performers have more consistent routines a contributory factor to the higher level of performance and consistency they produce? Or is the consistency merely a function of longer time spent practising? Understanding the behavioural components of routines and their relationship with mental processes is the next step (Cohn *et al.*, 1990).

Underlying psychological processes

Research exploring pre-performance routines in sport has not, to date, comprehensively explored in depth the psychological processes that occur during the routine stage prior to the execution of the required movement, even though the importance of a positive affective state prior to competition has been identified (Hardy, Jones, & Gould, 1996). Indeed, it could be argued that inappropriate mental states can lead to task-irrelevant thoughts, loss of attention, and inappropriate physical states which can result in poor performance (Boutcher, 1990). The majority of previous researchers in the area have suggested a number of potential psychological processes, which include the utilization of imagery (Hall, Rodgers, & Barr, 1990) and distracting the attentional focus from irrelevant thoughts to task relevant thoughts (Maynard, 1998). It has also been suggested that the pre-performance routine specifically improves both concentration and performance (Harle & Vickers, 2001), and enhances the recall of physiological and psychological states (Marlow *et al.*, 1998). But as previously highlighted, these suggestions are not based upon empirical findings. Cohn *et al.* (1990) in their study exploring the effect of a cognitive-behavioural intervention on a pre-shot routine concluded that future research should explore the covert mental routine, but to date this does not appear to have been explored. Shaw (2002), in his case study of a professional golfer, reported that the professional golfer had experienced some attentional benefits arising from the use of

a pre-performance routine. Specifically, the golfer reported that 'the new routine had made him more focused for each shot and therefore, less distracted by irrelevancies' (p. 117). However, although a number of psychological processes have been suggested to accompany the pre-performance routine, to date only Jackson and Baker (2001), and Cotterill, Sanders, and Collins (2010) have explored these processes in detail despite the potential benefits that a greater understanding of these processes would have for the performer, coach and sport psychologist. Jackson and Baker (2001) in their case study of an elite rugby kicker found that the player utilized a range of psychological strategies including specific mental cues, thought stopping, inverse simulation, visualization and relaxation techniques, but interestingly these differed from attempt to attempt. Indeed the authors concluded that the most important determinant of kicking performance in the competitive environment was the successful application of specific psychological strategies rather than the temporal consistency of the pre-performance routine. Cotterill *et al*. (2010) in their phenomenological study of elite golfers interviewed six participants to explore the psychological strategies and techniques used. They concluded that 'the development of pre-performance routines, and in particular the psychological skills employed within the routines, is dependent on the personality, coping resources, and situational appraisals of each individual performer' (p. 19). To date, there is limited research exploring the psychological processes and strategies adopted by performers. Do performers employ a consistent set of skills and strategies with each performance or are they more transient? How do performers develop these psychological strategies and skills? Are pre-performance routines taught or do they evolve independently over time? Answers to these questions would allow for the development of more effective routines.

Teaching and developing pre-performance routines

A number of approaches have been suggested in order to attempt to achieve consistent and highly effective performance. These include Singer's (1988) five-step approach and Murphy's (1994) four-point model. The five steps proposed by Singer (see Figure 1) were readying, imaging, focusing attention, executing and evaluating. Lidor and Tenenbaum (1993) implemented this five-step model with basketball players and found the most important stage to be the readying stage, the preparation to perform. They reported that the greater the preparation time, the greater the success rate. Cotterill (2008) in a review of the practical guidelines to developing pre-performance routines in golf suggested that the first four steps of Singer's (1988) five-step approach (readying, imaging, focusing attention, executing) could be used as a

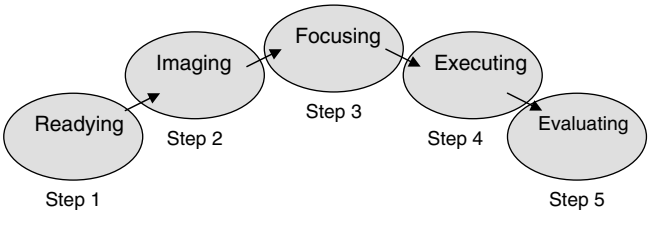

Figure 1. Singer's (1988) five-step approach.

global template for golf routines. It was suggested that this global template would allow the flexibility for the routine to be modified regarding behaviours and timing, but still fulfil the requirements of the individual golfer. Liu and Zhang (2003) used Singer's approach for their 'specific pre-performance routine group' when comparing the effects of a specific and a self-developed routine. Results demonstrated significant differences with the specific group performing better.

Murphy's (1994) model (see Figure 2) was dubbed the 'performance management model'. The steps he advocated were: practice, preparation, performance and analysis to create the 'flow state'. Murphy (1994) suggested this approach leads to optimal performance as performers have control over the internal environment in which the game is played, but not the external environment. There are currently limited publications that have explored the application of this particular approach.

A significant portion of research exploring pre-performance routines in sport has focused on the behavioural and temporal characteristics of the routines. As a result, recommendations have in the main focused on developing consistency in both. Crews and Boutcher's (1986) study of elite golfers highlighted that consistency of the timing and behavioural characteristics were key to the eventual impact of the routine itself. Indeed Crews and Boutcher (1986) advocated that the timing of the routines was essential with expert players taking longer to execute their routine at both putting and full swing shots. Extending this contention, Boutcher (1990) recommended that performers should assess the consistency of their pre-performance routines by time analysis. Douglas and Fox (2002) further argued that professional golfers drill themselves to perform a pre-shot routine regardless of the situation, contending that this factor may actually distinguish the very best and highly competent professional golfers. This very prescriptive approach has been questioned by a number of authors including Cotterill (2008), Holder (2003), and Jackson and Baker (2001). Jackson and Baker suggested that although consistency in the sequence of behaviours is important, other factors such as task difficulty significantly influenced the duration of the routine. Holder (2003) emphasized that the most critical feature of the application of pre-performance routines is their individualization, highlighting that what performers do, as opposed to how long it takes them, is key. Cotterill (2008) further endorsed this 'individualized' approach, advocating that each routine should be modelled around the needs of the individual performer. However, while advocating an individualized approach, Cotterill (2008) suggested that a generic template for the routine, based upon the psychological demands, was crucial. This suggestion was made specifically with golf in mind where research has indicated that golfers utilized different behavioural and temporal routines for different shot types. This solution offers the opportunity to develop one routine which could be applied differently depending on the task demands.

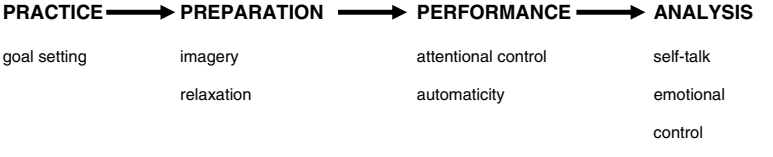

Figure 2. Murphy's (1994) four-step performance management model.

Pre-performance routines for learners and novices

Lidor and Singer (2000) suggested that in order to effectively use pre-performance routines in sport, one should acquire the technique(s) as early as possible in the process of learning the relevant skills. However, they also highlighted that at the time the current literature did not provide any recommendations regarding (1) how to teach them to learners, (2) incorporating the routine with successful performance, or (3) integrating routines into competitive situations. Lidor and Singer (2000) sought to rectify this by suggesting their guidelines for pre-performance phases. These phases, outlined in Table 2, include readying, focusing attention, and evaluating. Lidor and Mayan (2005) suggested that another benefit of developing pre-performance routines early in the learning process is that it assisted in developing a plan of action and activating appropriate physical and cognitive processes. This suggests that learners 'would then know more about how to manage their own cognitive processes and how to analyze themselves and situational demands' (p. 360). Further detailed exploration of individual cases of a longitudinal nature here would provide a greater insight into the teaching and development of routines from novice through to expert. Regarding the learning and development of pre-performance routines, the views, perceptions and understanding of the coach/instructor have been widely overlooked. Coaches influence and mould the development of pre-performance routines but where does their knowledge and understanding originate? How do coaches teach and develop routines? Future research should look to answer these questions and explore the impact that the coach has on the routines' development and the performers' understanding of routine importance and function.

Table 2. Guidelines for pre-performance phases (Lidor & Mayan, 2005).

	Phase 1	Phase 2	Phase 3
Psychological foundation	Readying (mechanical, mental, and emotional)	Focusing attention	Evaluating
Emphasis	Directing thoughts and emotions to create an optimal state for learning and/or performing	Selecting a relevant external cue and focusing intently on it	Using self-feedback for analysis and subsequent improvement
Guidelines	● Establishing a consistent basic position ● Feeling comfortable ● Generating +ve thoughts and emotions about performance expectations ● Developing confidence ● Developing awareness ● Visualising best performance ● Feeling the movements ● Developing awareness of body parts.	● Focusing attention on one situational cue or thought ● Maintaining this focus ● Blocking out internal distractions ● Blocking out external distractions ● Executing with a quiet mind.	● Judging the outcome of the performance ● Assessing the processes and strategies that produced the movement ● Determining better ways to perform in the future

Approaches to measuring, quantifying, and understanding routines

There are a number of research approaches that have been utilized to explore pre-performance behaviours, techniques and strategies in sport. Specifically, research has focused on recording the duration, order and instances of certain categories of behaviours, measured attention-related events using psychophysiology, and explored the psychological techniques and strategies utilized by players through direct interviews.

Behaviouralltemporal description

Wrisberg and Pein (1992) suggested that in order to study pre-performance routines meaningfully, the researcher must decide how to quantify them. Previous measures exploring pre-performance behaviour in sport have focused on measuring the frequency, duration and consistency of the participants' behaviours prior to and during the execution of performance. For example, Boutcher and Zinsser (1990), in their study exploring cardiac deceleration in elite and beginning golfers during putting, specifically looked at the number of practice swings and the number of glances at the hole of participants. A similar approach was adopted also by Cotterill and Collins (2003), Crews and Boutcher (1986), and Douglas and Fox (2002), who used a modified version of events recording (Siedentop, 1983), including a number of discrete behavioural actions (practice swings, waggles and glances at the target or hole) occurring pre and post shot; the number of actions; their order; and certain time aspects. Jackson (2001), and Jackson and Baker (2001) followed similar guidelines in recording the glances at the posts and number of steps in rugby penalty kicking. This approach involves the recording of the type and sequence of behaviours and actions that a performer demonstrates whilst executing their pre-performance routine. Categorizing all observed behaviours is important to reduce the overall number of variables. The sequence and duration of these behaviours are important to understand whether performers are doing the same things in the same order prior to performance. This can then be explored in relation to good *vs.* poor performance or elite *vs.* novice performers. Recording behaviours also allows the clear identification of the beginning and end of a routine. As a result overall durations of the routines can be compared. Taking this a step further, the relative durations of the discrete behavioural routines can also be compared, in particular checking for the impact of other variables such as task difficulty on the overall and relative durations.

Understanding through the participant

A small number of researchers have adopted an interview-based approach to exploring performer thoughts and perceptions. Vergeer and Hanrahan (1998, p. 52) interviewed 16 dancers, asking 'What methods, strategies, and techniques other than physical preparation do you use to train yourself mentally and emotionally to improve your dancing?' Cohn *et al*. (1990) used interviews with their three male golfers to discover whether the participants used routines, and how frequent this use was. Lidor and Mayan (2005) used brief interviews when exploring whether beginners can benefit from pre-performance routines. However, the focus of this

prior research has failed to explore the performer's views on the function that their pre-performance fulfilled or the psychological strategies they employed, and more importantly why they employed them. Jackson and Baker (2001) asked similar questions in their case study of an elite rugby goal kicker while Cotterill *et al*. (2010) conducted a phenomenological analysis exploring both the function of the routines utilized and the psychological skills employed by their six elite golfers. Both of these studies have focused on small sample sizes, and as a result, their generalizability can be questioned. Cotterill *et al*. (2010) adopted a 'think aloud protocol' similar to that used by Ericsson and Simon (1993) and further developed by Ram and McCullagh (2003), where participants were asked to verbalize the underlying cognitive processes relating to specific observed behaviours. This was achieved using video footage of the pre-performance routines as a prompt.

Direct methods for measuring underlying psychological processes and strategies

An alternative to the use of self-report measures for studying psychological processes during preparation for performance can be provided by psychophysiological methods (Hassmén & Kolvula, 2001). Psychophysiology can be defined as 'the scientific study of cognitive, emotional and behavioural phenomena as related to and revealed through physiological principles and events' (Cassioppo & Tassinary, 1990, p. ix). This research approach was supported by Lawton, Hung, Saarela, and Hatfield (1998) who advocated the use of psychophysiological measures as an effective way of observing and measuring mental processes during real-time performance. Lawton *et al*. (1998) further suggested that this measure could then be related to the underlying nervous system processes being utilized by the performer during the pre-performance period.

This particular approach to measuring psychological processes is particularly useful as it can 'provide an objective and relatively non-invasive method of examining the complex processes involved in sports performance as they take place' (Collins, 2002, p. 17). This approach can provide an unobtrusive, objective and real-time measurement of mental processes associated with sports performance (Hung, 2002). The psychophysiological methods most suited to the study of mental processes during 'real-time' performance and preparation are the use of heart rate changes and electroencephalography. Singer (2002) suggested that on the basis of the psychophysiological evidence to date, which has been obtained primarily in aiming sports, outstanding athletes and performances could be distinguished from other athletes and performances in the pre-performance state.

Cardiac deceleration

Cardiac deceleration is a measure of the duration of time between a specific, reoccurring point of the cardiac cycle and the next corresponding point. Lacey and Lacey (1966) proposed that decreases in cardiac activity prior to performance facilitate attentional processes. This was due to decreased feedback to the brain associated with a decrease in cardiac activity. Janelle, Singer, and Williams (1999) suggested that when the act requires an internal attentional focus, heart rate acceleration results in greater cortical activity. Landers *et al*. (1991) reported that

there tends to be a decrease in heart rate during the preparation and concentration phase related to performing a motor skill.

Boutcher and Zinsser's (1990) study of university golfers measured the inter-beat intervals (IBIs) between heartbeats immediately prior to, during and post completing a putting task. Their results showed that this IBI increased significantly in length prior to performance, indicating a decrease in heart rate. Boutcher and Zinsser's overall conclusions indicated that there was a greater cardiac deceleration associated with superior putting performance. Radlo, Steinberg, Singer, Barba, and Melnikov (2002) also reported that when each performer's four best and worst throws were analysed in conjunction with heart rate, the results showed that a significant heart rate deceleration was associated with the best shots. Additionally, the worst shots were associated with a significant increase in heart rate.

Electrodermal activity

A small number of studies have used electrodermal indicators to explore cognitive function. Tremayne and Barry (2001) took electrodermal measurements to cater for the degree of activation as a potential confounding variable whilst also recording heart-rate data. Guillot, Collet, Molinaro, and Dittmar (2004) also recorded electrodermal activity, specifically recording skin resistance and potential blood flow, skin temperature, and heart rate. Guillot *et al*. (2004) reported that a major negative skin potential response was found in concentration and shooting phases for best shots, suggesting that there could be a link between the autonomic nervous system and good performance.

Electroencephalography

Electroencephalography (EEG) uses electrodes attached to the scalp to record the changes in electrical potential, which accompany peripheral nerve activity in the brain. This measure is then used as an indicator of neural function. Lawton et al. (1998) concluded that there is a fairly widespread decrease in cerebral activity when preparing immediately to perform motor tasks. Specific cortex areas of interest are the occipital, parietal and temporal lobes of the brain. Salazar et al. (1990) reported that when four best and worst archery shots were compared, increases in alpha activity in the left hemisphere were related to poorer performance.

Crews, Lutz, Nilsson, and Marriott (1998) in their study exploring psychophysiological indicators during golf putting suggested that EEG measures of automatic, successful performance confirm that low levels of activity exist in various areas of the brain immediately prior to initiating the stroke during the golf putt. These results appeared to reinforce previous findings (Crews & Landers, 1993; Hatfield, Landers, & Ray, 1984) that suggested that increased alpha activity was related to reduced error, and a quieting of the left hemisphere appears important for successful performance. Understanding EEG data in relation to the pre-performance period would offer a greater understanding of the psychological strategies employed by performers.

Various recent studies have explored the alpha power characteristics exhibited by sports performers in various environments. Janelle et al. (2000) reported that expert marksmen exhibited a significant increase in left hemisphere alpha power (a more

relaxed state) compared with the right hemisphere, as well as asymmetrical patterns of alpha and beta activity in both hemispheres. Landers et al. (1994) reported that the amounts of alpha activity across both hemispheres at the beginning of learning were relatively low. However, as the participants become more skilled, an increase in alpha activity was evident in the left hemisphere while activity in the right hemisphere remained constant. All of these studies suggest a link between alpha power, particularly in the left hemisphere, and the pre-performance state.

While attention concerns the selection of input to the organism, intention refers to the selection of output (O'Connor, 1981). The perception of objects requires attention to external space with the consequent peripheral feedback; control of action depends on the implementation of internal plans and can be a feed-forward process (Hoff & Abib, 1992). This implies the organism is looking ahead towards a new state, the representation of which steers the transformation until its completion (Jeannerod, 1994). The intention mode of behaviour probably uses feed-forward control, based on centrally stored instructions, to monitor the relationship between the actual and predicted trajectories (Loze, Collins, & Shaw, 1999). When a task being performed is well known to the individual and is performed in a predictable environment, there is a change from attentional control to intentional control. Prior to performance there is a shift from the external environment to the internal environment. In essence there is a shift from attention to external sensory stimulus to an intentional state. This intentional state refers to the selection of motor output prior to skill execution based on an internal representation of the skill and the appropriate action(s) necessary for a successful performance (Jeannerod, 1994).

The shift to intention is reflected in EEG. Alpha power has been shown to reflect the level of visual attention to external stimuli. Due to the decrease in processing of external sensory information, there is an increase in alpha frequency and power in the occipital and parietal cortex. In target sports this shift from attention to intention is generally acknowledged as occurring 2.5 seconds prior to trigger release. This shift, however, is individualistic and dependent on task difficulty. Loze, Collins, and Holmes (2001) in a study with elite shooters examined the pre-shot occipital EEG alpha power activity of elite air-pistol shooters. Specifically they selected the best and worst five shots for each shooter based on four indicators of shot quality, which were either outcome based or rated by experts. Loze *et al*. (2001) found that pre-shot alpha power increased through epochs 1 to 3 prior to best shots, but decreased prior to worst shots. They also found that alpha power was also significantly greater during the final pre-shot epochs of the best shots. This implies that prior to best performance in closed skill tasks there is an increase in occipital alpha power immediately prior to performance. This indicates that achieving this state is essential to achieving optimal performance levels. Comparing the pre-paratory stages of good and poor performance in golf could offer an insight into exactly what the optimal cognitive state prior to performance is and possibly how the performer can achieve the required psychological state prior to performance. A logical next step, in the use of heart rate and EEG methods, is to explore the potential coupling between psychophysiological indicators and specific routine behaviours and thought patterns.

Gaps in current knowledge and directions for future research

Pre-performance routines have been well observed and described. Future research needs to go beyond this point. The first step is to develop a clear understanding of what function routines actually fulfil. One approach here would be the adoption of qualitative methodologies to explore the thoughts, feelings and understanding of the performers who so readily use pre-performance routines as a core component of their performance. More mixed study designs are also required to test some of the hypothesized functions of the routine such as enhancing the recall of psychological and physiological states (Marlow *et al.*, 1998) and acting as a trigger for well learnt movement patterns (Crews & Boutcher, 1986; Moran, 1996).

There has been extensive description of the behaviours that constitute the routines used by performers, specifically focusing on behaviour frequency, consistency and temporal components. The associated mental skills or processes underpinning these behaviours have received much less attention. Are these mental skills as consistent as these physical behaviours? Do they link/couple with the behaviours or are they separate? How does the use of these skills and strategies evolve over time? Are they taught or do they develop independently? On this last point, study designs that are more longitudinal in nature would be welcome. Specifically, a greater insight into the teaching and development of routines from novice through to expert is needed. Regarding the learning and development of pre-performance routines, the views, perceptions and understanding of the coach/instructor have been widely overlooked. However, the coach is often cited as a key influence on the performers' skill development and consistency. How do coaches teach and develop routines? Future research should look to answer these questions and explore the impact that the coach has on the development of routines and performers' understanding of their importance and function. Finally, researchers should seek to explore potential relationships between psychophysiological indicators, behaviour components, and reported mental components of pre-performance routines.

References

Beauchamp, P.H., Halliwell, W.R., Fournier, J.F., & Koestner, R. (1996). Effects of cognitive-behavioral psychological skills training on the motivation, preparation, and putting performance of novice golfers. *Sport Psychologist*, *10*, 157–170.

Beilock, S.L., & Carr, T.H. (2001). On the fragility of skilled performance: What governs choking under pressure? *Journal of Experimental Psychology: Generalize*, *130*, 701–725.

Beilock, S.L., Carr, T.H., MacMahn, C., & Starkes, J.L. (2002). When paying attention becomes counterproductive: Impact of divided versus skill focused attention on novice and experienced performers of sensorimotor skills. *Journal of Experimental Psychology: Applied*, *8*, 6–16.

Boutcher, S.H. (1990). The role of performance routines in sport. In J.G. Jones & L. Hardy (Eds.), *Stress and performance in sport* (pp. 231–245). New York: J. Wiley.

Boutcher, S.H. (1992). Attention and athletic performance: An integrated approach. In T.S. Horn (Ed.), *Advances in sport psychology* (pp. 251–266). Champaign, IL: Human Kinetics.

Boutcher, S.H., & Crews, D.J. (1987). The effect of a preshot attentional routine on a well learned skill. *International Journal of Sport Psychology*, *18*, 30–39.

Boutcher, S.H., & Zinsser, N.W. (1990). Cardiac deceleration of elite and beginning golfers during putting. *Journal of Sport and Exercise Psychology*, *12*, 37–47.

Calmels, C., & Fournier, J. (2001). Study of the duration of physical and mental execution of gymnastic movement. *The Sport Psychologist*, *15*, 142–150.

Cassioppo, J.Y., & Tassinary, L.G. (Eds.) (1990). *Principles of psychophysiology: Physical, social and inferential elements*. Cambridge: Cambridge University Press.
Cohn, P.J., Rotella, R., & Lloyd, J.W. (1990). Effects of a cognitive-behavioral intervention on the pre-shot routine and performance in golf. *The Sport Psychologist*, *4*, 33–42.
Collins, D. (2002). Psychophysiology and athletic performance. In B. Blumenstein, M. Bar-Eli, & G. Tenenbaum (Eds.), *Brain and body in sport and exercise* (pp. 15–36). Chichester: John Wiley and Sons.
Cotterill, S. (2008). Developing effective pre-performance routines in golf. *Sport & Exercise Psychology Review*, *4*(2), 10–16.
Cotterill, S., & Collins, D. (2003) Exploring the consistency of pre-shot routines across shot-type in golf. In *Proceedings of the XIth European Congress of Sport Psychology*, Copenhagen. Copenhagen: Det Samfundsvidenskabelige Fakultets Reprocentre.
Cotterill, S., & Greenlees, I. (2003). Temporal consistency of pre-performance routines in world-class polevaulters. *Proceedings from the VIIth IOC World Congress on Sport Sciences*, Athens. Athens: Organising Committee for the Olympic Games.
Cotterill, S., Sanders, R., & Collins, D. (2010). Developing effective pre-performance routines in golf: Why don't we ask the golfer? *Journal of Applied Sport Psychology*, *22*, 51–64.
Crampton, J. (1989). Establishing pre-shot routines for tournament golfers: An example of the use of micro-computers in performance planning. *Sports Coach*, *12*, 9–12.
Crews, D.J., & Boutcher, S.H. (1986). An exploratory observational behavior analysis of professional golfers during competition. *Journal of Sport Behaviour*, *9*, 51–58.
Crews, D.J., & Landers, D.M. (1993). Electroencephalagraphic measures of attentional patterns prior to the golf putt. *Medicine in Sport and Exercise*, *25*, 116–126.
Crews, D., Lutz, P., Nilsson, P., & Marriott, L. (1998). Psychophysiological indicators of confidence and habituation during golf putting. In M.R. Farrally & A.J. Cochran (Eds.), *Science and golf III* (pp. 159–165). Champaign, IL: Human Kinetics.
Czech, D.R., Ploszay, A.J., & Burke, K.L. (2004). An examination of the maintenance of preshot routines in basketball free throw shooting. *Journal of Sport Behavior*, *27*, 323–329.
Douglas, K., & Fox, K.R. (2002). Performance and practise of elite women European tour golfers during pressure and non-pressure putting simulation. In E. Thain (Ed.), *Science and golf IV* (pp. 246–256). London: Routledge.
Ericsson, K.A., & Simon, H.A. (1993). *Verbal reports as data*. Cambridge, MA: MIT Press.
Fairweather, K.G., & Potgeiter, J.R. (1993). The effect of pre-shot strategies on golf putting. South African Journal for Research in Sport. *Physical Education and Recreation*, *16*, 35–40.
Foster, D.J., Weigand, D.A., & Baines, D. (2006). The effect of removing superstitious behavior and introducing pre-performance routine on basketball free-throw performance. *Journal of Applied Sport Psychology*, *18*, 167–171.
Gayton, W.F., Cielinski, K.L., Francis-Keniston, W.J., & Hearns, J.F. (1989). Effects of pre-shot routine on free-throw shooting. *Perceptual and Motor Skills*, *68*, 317–318.
Gould, D., & Udry, E. (1994). Psychological skills for enhancing performance: Arousal regulation strategies. *Medicine and Science in Sport and Exercise*, *26*, 478–485.
Gould, D., Weiss, M., & Weinberg, R. (1981). Psychological characteristics of successful and non-successful big ten wrestlers. *Journal of Sport Psychology*, *3*, 69–81.
Guillot, A., Collet, C., Molinaro, C., & Dittmar, A. (2004). Expertise and peripheral autonomic activity during the preparation phase in shooting events. *Perceptual Motor Skills*, *98*, 371–381.
Haddad, K., & Tremayne, P. (2009). The effects of centering on the free-throw shooting performance of young athletes. *The Sport Psychologist*, *23*, 118–136.
Hall, C.R., Rodgers, W.M., & Barr, K.A. (1990). The use of imagery by athletes in selected sports. *The Sport Psychologist*, *4*, 1–10.
Hall, E.G., & Erffmeyer, E.S. (1983). The effect of visuo-motor behavior rehearsal with videotaped modeling on free throw accuracy of intercollegiate female basketball players. *Journal of Sport Psychology*, *5*, 343–346.
Hardy, L., Jones, G., & Gould, D. (1996). *Understanding psychological preparation for sport: Theory and practise of elite performers*. Chichester: John Wiley and Sons.
Harle, S.K., & Vickers, J.N. (2001). Training quiet eye improves accuracy in basketball free throw. *The Sport Psychologist*, *15*, 289–305.

Hassmén, P., & Kolvula, N. (2001). Cardiac deceleration in elite golfers as modified by noise and anxiety during putting. *Perceptual and Motor Skills*, *92*, 947–957.

Hatfield, B.D., Landers, D., & Ray, W.J. (1984). Cognitive processes during self-paced motor performance: An electroencephalographic profile of skilled marksmen. *Journal of Sport Psychology*, *6*, 42–57.

Highlen, P.S., & Bennett, B.B. (1983). Elite divers and wrestlers: A comparison between open and closed skill athletes. *Journal of Sport Psychology*, *5*, 390–409.

Hill, K.L., & Borden, F. (1995). The effect of attentional cueing scripts on competitive bowling performance. *International Journal of Sport Psychology*, *26*, 503–512.

Hoff, B., & Abib, M.A. (1992). A model of the effects of speed, accuracy and perturbation on visually guided reaching. In R. Caminiti, P.B.V. Johnson, & Y. Burnod (Eds.), *Control of arm movement in space* (pp. 285–306). Berlin: Springer-Verlag.

Holder, T. (2003). Concentration training for closed skills. Pre-performance routine. In I. Greenlees & A. Moran (Eds.), *Concentration skills training in sport* (pp. 67–75). Leicester: The British Psychological Society.

Hung, T.M. (2002). Brain activity and sport performance: Implications for sport psychologists [Abstract]. *Journal of Sport and Exercise Sciences*, S16.

Jackson, R.C. (2001). Consistency of pre-performance routines: Analysis of the 1999 Rugby World Cup. *Journal of Sports Science*, *20*, 21–22.

Jackson, R.C. (2003). Pre-performance routine consistency: Temporal analysis of goal kicking in the Rugby Union World Cup. *Journal of Sports Sciences*, *21*, 803–814.

Jackson, R.C., & Baker, J.S. (2001). Routines, rituals, and rugby: Case study of a world class goal kicker. *The Sport Psychologist*, *15*, 48–65.

Janelle, C.M., Hillman, C.H., Apparies, R.J., Murray, N.P., Meili, L., Fallon, E.A., & Hatfield, B.D. (2000). Expertise differences in cortical activation and gaze behavior during rifle shooting. *Journal of Sport and Exercise Psychology*, *22*, 167–182.

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

Jeannerod, M. (1994). The representing brain: Neural correlates of motor intention and imagery. *Behavioral and Brain Sciences*, *17*, 187–245.

Keele, S.W. (1973). *Attention and human performance*. Pacific Palisales, CA: Goodyear.

Kingston, K.M., & Hardy, L. (2001). Pre-performance routine training using holistic process goals. In P.R. Thomas (Ed.), *Optimizing performance in golf* (pp. 264–278). Brisbane: Australian Academy Press.

Kirschenbaum, D.S. (1987). Self-regulation of sport performance. *Medicine and Science in Sport and Exercise*, *19*, S106–51B.

Kirschenbaum, D.S., & Bale, R.M. (1980). Cognitive-behavioral skills in golf: Brain power in golf. In R.M. Suinn (Ed.), *Psychology in sports: Methods and applications* (pp. 275–287). Minneapolis: Burgess.

Kirschenbaum, D.S., Tomarken, A.J., & Ordman, A.M. (1982). Specificity of planning and choice applied to adult self-control. *Journal of Personality and Social Psychology*, *41*, 576–585.

Lacey, B.C., & Lacey, J.L. (1966). *Change in cardiac response and reaction time as a function of motivation*. Paper presented at the meeting of the Society for Psychophysiological Research, Denver, CO.

Lamirand, M., & Rainey, D. (1994). Mental imagery, relaxation, and accuracy of basketball foul shooting. *Perceptual Motor Skills*, *78*, 1229–1230.

Landers, D.M., Han, M., Salazar, W., Petruzzello, S.J., Kubitz, K.A., & Gannon, T.L. (1994). Effects of learning on electroencephalographic and electrocardiographic patterns in novice archers. *International Journal of Sport Psychology*, *25*, 313–330.

Landers, D., Petruzzello, S.J., Salazar, W., Crews, D.J., Kubitz, K.A., Gannon, T.L., & Han, M. (1991). The influence of electrocortical biofeedback on performance in pre-elite archers. *Medicine and Sciences in Sports and Exercise*, *23*, 123–129.

Lawton, G.W., Hung, T.M., Saarela, P., & Hatfield, B. (1998). Electroencephalography and mental states associated with elite performance. *Journal of Sport and Exercise Psychology*, *20*, 35–53.

Lidor, R., Arnon, M., & Bronstein, A. (1999). The effectiveness of a learning (cognitive) strategy on free-throw performance in basketball. *Applied Research in Coaching & Athletics Annual*, *14*, 59–72.

Lidor, R., & Mayan, Z. (2005). Can beginning learners benefit from preperformance routines when serving in volleyball? *The Sport Psychologist*, *19*, 343–363.

Lidor, R., & Singer, R.N. (2000). Teaching pre-performance routines to beginners. Journal of Physical Education. *Recreation and Dance*, *71*, 34–36.

Lidor, R., & Tenenbaum, G. (1993). Applying learning strategy to a basketball shooting skill: A case study report. In R. Lidor, D. Ben-Sira, & Z. Artzi (Eds.), *Physical activity in the lifecycle: The 1993 FIEP World Congress proceedings*. Netanya, Israel.

Liu, J., & Zhang, Y. (2003). The effects of two types of preperformance routine on the acquisition, retention, and transfer of a motor skill. *Research Quarterly for Exercise and Sport*, *74*, A-33.

Lobmeyer, D.L., & Wasserman, E.A. (1986). Preliminaries to free throw shooting: Superstitious behavior? *Journal of Sports Behavior*, *9*, 70–78.

Lonsdale, C., & Tam, J.T.M. (2007). On the temporal and behavioral consistency of preperformance routines: An intra-individual analysis of elite basketball players' free throw shooting accuracy. *Journal of Sports Sciences*, *26*, 259–266.

Loze, G.M., Collins, D.J., & Holmes, P.S. (2001). Pre-shot EEG alpha-power reactivity during expert air-pistol shooting: A comparison of best and worst shots. *Journal of Sport Sciences*, *19*, 727–733.

Loze, G.M., Collins, D., & Shaw, J.C. (1999). EEG Alpha Rhythm intention and occulomotor control. *International Journal of Psychophysiology*, *33*, 163–167.

Mack., M.G. (2001). Effects of time and movements of the preshot routine on free throw shooting. *Perceptual and Motor Skills*, *93*, 567–573.

Mahoney, M.J., & Avener, M. (1977). Psychology of the elite athlete: An exploratory study. *Cognitive Therapy and Research*, *6*, 335–342.

Marlow, C., Bull, S., Heath, B., & Shambrook, C. (1998). The use of a single case design to investigate the effect of a pre-performance routine on the water polo penalty shot. *Journal of Science and Medicine in Sport*, *1*, 143–155.

Maynard, I.W. (1998). *Improving concentration*. Leeds: National Coaching Foundation.

McCann, P., Lavallee, D., & Lavallee, R.M. (2001). The effect of pre-shot routines on golf wedge shot performance. *European Journal of Sport Science*, *1*, 231–240.

Mesagno, C., Marchant, D., & Morris, T. (2008). A pre-performance routine to alleviate choking in 'choking-susceptible athletes'. *The Sport Psychologist*, *22*, 439–457.

Moore, W.E., & Stevenson, J.R. (1994). Training a pre-shot routine for golf. *Applied Research in Coaching and Athletics Annual*, 161–167.

Moore, W.S. (1986). Covert-overt service routine and play better. *Golf Digest*, 115–117.

Moran, A.P. (1996). *The psychology of concentration in sports performers: A cognitive analysis*. Hove: Psychology Press.

Moran, A. (2004). *Sport and exercise psychology: A critical introduction*. Hove: Routledge.

Murphy, S. (1994). Mental preparation for golf: Achieving optimal performance. In A.J. Cochrane & M.R. Farrally (Eds.), *Science and golf II: Proceedings of the world scientific congress of golf* (pp. 162–167). London: E and FN Spon.

Nideffer, R.M. (1976). *The inner athlete: Mind plus muscle for winning*. San Diego, CA: Enhanced Performance Associates.

O'Connor, K. (1981). The intentional paradigm and cognitive psychology. *Psychophysiology*, *18*, 121–128.

Orlick, T. (1986). *Psyching for sport: Mental training for athletes*. Champaign, IL: Human Kinetics.

Predebon, J., & Docker, S.B. (1992). Free-throw shooting performance as a function of preshot routines. *Perceptual and Motor Skills*, *75*, 167–171.

Radlo, S.J., Steinberg, G.M., Singer, R.N., Barba, D.A., & Melnikov, A. (2002). The influence of an attentional focus strategy on alpha brain wave activity, heart rate, and dart throwing performance. *International Journal of Sport Psychology*, 33, 205–217.

Ram, N., & McCullagh, P. (2003). Self-modeling: Influence on psychological responses and physical performance. *The Sport Psychologist*, *17*, 220–241.

Rotella, R.J., & Bunker, L.K. (1981). *Mind mastery for winning golf*. Englewood Cliffs, NJ: Prentice-Hall.
Salazar, W., Landers, D.M., Petruzzello, S.J., Han, M., Crews, D.J., & Kubitz, K.A. (1990). Hemispheric asymmetry, cardiac response, and performance in elite archers. *Research Quarterly for Exercise and Sport*, *61*, 351–359.
Schack, T. (1997). Ängstliche Schűler im Sport – interventionsverfahren zur Entwicklung der Handlungskontrolle [Anxious students in sports: Intervention procedures for the development of action control]. Schorndorf: Hofmann.
Schmidt, R.A. (1988). *Motor control & learning: A behavioral emphasis* (2nd ed.). Champaign, IL: Human Kinetics.
Shaw, D. (2002). Confidence and the pre-shot routine in golf: A case study. In I. Cockerill (Ed.), *Solutions in sport psychology* (pp. 108–119). London: Thomson.
Siedentop, D. (1983). *Developing teaching skills in physical education* (2nd ed.). California: Mayfield.
Singer, R.N. (1988). Strategies and meta-strategies in learning and performing self-paced athletic skills. *The Sport Psychologist*, *2*, 49–68.
Singer, R.N. (2002). Pre-performance state, routines, and automaticity: What does it take to realize expertise in self-paced events? *Journal of Sport and Exercise Psychology*, *24*, 359–375.
Southard, D., & Amos, B. (1996). Rhythmicity and preperformance ritual: Stabilizing a flexible system. *Research Quarterly for Exercise and Sport*, *67*, 288–296.
Southard, D.L., & Miracle, A. (1993). Rhythmicity, ritual and motor performance: A study of free-throw shooting in basketball. *Research Quarterly for Exercise and Sport*, *64*, 287–290.
Southard, D.L., Miracle, A., & Landwer, G. (1989). Ritual and free throw shooting in basketball. *Journal of Sports Sciences*, *7*, 163–173.
Thomas, P.R., & Over, R. (1994). Psychological and psychomotor skills associated with performance in golf. *The Sport Psychologist*, *8*, 73–86.
Tremayne, P., & Barry, R.J. (2001). Elite pistol shooters: Physiological patterning of best vs. worst shots. *International Journal of Psychophysiology*, *41*, 19–29.
Vealey, R. (1988). Future directions in psychology skills training. *Sport Psychology*, *7*, 318–336.
Vergeer, I., & Hanrahan, C. (1998). What modern dancers do to prepare: Content and objectives of preperformance routines. *AVANTE*, *4*, 49–71.
Weinberg, R.S. (1988). *The mental advantage*. Champagne, IL: Leisure Press.
Williams, A.M., Davids, K., & Williams, J.K. (1999). *Perception and action in sport*. London: E and FN Spon.
Wrisberg, C.A., & Anshel, M.H. (1989). The effect of cognitive strategies on the free throw shooting performance of young athletes. *The Sport Psychologist*, *3*, 95–104.
Wrisberg, C.A., & Pein, R.C. (1992). The pre-shot interval and free throw shooting accuracy: An exploratory investigation. *The Sport Psychologist*, *6*, 14–23.
Yancey, R. (1977). Develop a pre-shot routine and play better. *Golf Digest*, 115–117.