Psychology of Sport and Exercise 26 (2016) 52–60

Contents lists available at ScienceDirect

Psychology of Sport and Exercise

journal homepage: www.elsevier.com/locate/psychsport

Individual arousal-related performance zones effect on temporal and behavioral patterns in golf routines

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ARTICLE INFO

Article history:
Received 28 January 2016
Received in revised form
26 May 2016
Accepted 16 June 2016
Available online 17 June 2016

Keywords:
Routine
Individual arousal-related performance zone
Skilled golfers
Consistency

ABSTRACT

Aim: Consistency, both in duration and behavior, of pre-performance routines has been closely related to overall performance quality. However, recent findings highlight that psychological and physiological states may have important implications for routine consistency. To further clarify this relationship, the present study sought to examine changes in routine consistency with respect to optimal and non-optimal arousal states.
Method: The present case study observed the performance routines of three high-skilled golfers during three rounds of competitive golf. Measures of arousal (heart rate) and outcome performance were used to determine each golfer's Individual Arousal-related Performance Zones (IAPZs) (Kamata, Hanin, & Tenenbaum, 2002). Subsequently, temporal and behavioral patterns (consistency and number of rehearsal swings and glances toward the target) for both the full swing and golf putt were assessed across poor, moderate, and optimal levels of the golfer's IAPZ.
Results: Idiosyncratic differences in routine patterns, both behaviorally and temporally were evident. More importantly, the consistency of the routines for each golfer varied under different arousal-related performance zones. That is, the temporal and behavioral patterns of the golfers varied in idiosyncratic ways across the IAPZ levels.
Conclusions: These findings suggest that factors that influence a performer's arousal level can lead to idiosyncratic variations in a performer's routine. Observation of these routine changes can provide insight into the negative tendencies that an athlete can have when performing outside their optimal zone. With this knowledge, practitioners can be more effective in helping athletes monitor and regulate arousal, which will ultimately lead to enhanced performance.

"Golf is a game of consistency, and consistency begins with a sound pre-shot routine" (Rotella, 2012, p.85). Pre-shot routines, also known as pre-performance routines (PPR), represent a sequence of task-related thoughts and behaviors in which the athlete systematically engages in prior to performing a sports skill (Moran, 1996). Such routines are regularly observed in a variety of sports, most notably self-paced tasks and closed-skill sports (e.g., golf, bowling, basketball freethrow; Gentner, Gonzalez, Czech, & McGraw, 2008). It has been commonly suggested that the consistency, both in duration and behavior, of these routines are closely related to overall performance quality (Cotterill, 2010; Lidor & Singer, 2000; Thomas & Over, 1994). Importantly, situational factors such as arousal level may influence the observed temporal and behavioral features of a PPR resulting in decreased consistency, and ultimately inferior performance (Jackson & Baker, 2001). Consequently, it is important to explore and characterize the changes to routine behaviors associated with varying levels of arousal states. By doing so, athletes and coaches may be better able to counteract any inconsistencies in routine behavior brought about by non-optimal arousal states.

Primarily, research on PPR has been focused on the effect of behavioral and/or temporal consistencies on performance. Comparative evaluations of PPR consistency suggest that skilled participants are more consistent than their lesser skilled counterparts. For example, Boutcher and Zinsser (1990) examined the pre-performance behaviors of novice and skilled golfers prior to putting, and found that skilled golfers were significantly more

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http://dx.doi.org/10.1016/j.psychsport.2016.06.005
1469-0292/

consistent in demonstrating stereotyped behaviors than beginners. Likewise, Wrisberg and Pein (1992) examined the temporal consistency of pre-shot routines in collegiate basketball players over the course of a full season and found that the temporal consistency of the pre-shot interval was negatively correlated with free-throw success rate. In other words, players who had higher success rates also displayed greater temporal consistency in their PPR. Furthermore, Lonsdale and Tam (2008) found that during the NBA playoffs, players with the most consistent behavioral routines had higher free-throw success rates than those who displayed the highest temporal consistency. Such findings have led to the assumption that increased routine consistency (behaviorally or temporally) leads to improved performance (Jackson, 2003).

Specifically, the benefits of consistent pre-shot routines are associated with enhancing concentration by minimizing attention to irrelevant and distracting information (e.g., crowd noise, distracting thoughts, etc.) while also directing attention to task-relevant cues (e.g., wind direction, curvature of the putting surface, etc.; Boutcher & Zinsser, 1990; Cohn, Rotella, & Lloyd, 1990). Given limited information processing capacities, guiding the pickup of task-relevant information through a PPR functions to aid in the preparation and decision-making processes prior to skill execution (Masters & Malhotra, 2014; Tenenbaum, 2003). These routines may be especially important for performance during stressful or anxiety provoking situations, as stress can increase the susceptibility to attend to task-irrelevant cues prior to skill execution (Eysenck, Derakshan, Santos, & Calvo, 2007).

In this direction, Jackson (2003) observed temporal changes in PPR (e.g., longer concentration times and shorter physical preparation) for place kicks in Rugby when the score was close (i.e., increased situational pressure). More specifically, under pressure, players spent less time placing and moving into position for the kick, but stood longer behind the ball before initiating the run-up for the kick. Similarly, Bell, Finch, and Whitaker (2010) found that as the degree of task difficulty increased so too did their PPR times. Specifically, increased PPR times were associated with better performance when the task was more difficult. These findings highlight that psychological and physiological states may have important implications for the consistency of PPRs. As such, it is important to further explore the temporal and behavioral idiosyncrasies of PPRs associated with varying arousal states.

Optimal and non-optimal performance has been repeatedly associated with individual specific arousal states (e.g., Individual Zone of Optimal Functioning; Hanin, 1997, 2000; Kamata, Tenenbaum, & Hanin, 2002). However, to date, research on PPR has yet to consider the influence of arousal state on the quality and consistency of pre-shot routines. Research on the relationship between anxiety (a negative emotional state often accompanied by increased arousal) and performance (e.g., Baumeister, 1984; Beilock & Carr, 2001; Land & Tenenbaum, 2012), however, may provide important insights into the effect these factors may have on PPR. Specifically, anxiety and negative affect have been shown to negatively impact the quality and variability of motor behaviors (Collins, Jones, Fairweather, Doolan, & Priestley, 2001; Pijpers, Oudejans, Holsheimer, & Bakker, 2003), as well as the efficiency of information processing (Eysenck et al., 2007; Wine, 1971). Importantly, the degree of information processing has been linked to levels of consistency across a variety of domains including neurophysiology (Boutcher & Zinsser, 1990; Crews & Landers, 1993; Neumann & Thomas, 2009), perceptual expertise (Janelle, Duley, & Coombes, 2004), biomechanics (Deeny, Haufler, Saffer, & Hatfield, 2009; Era, Konttinen, Mehto, Saarela, & Lyytinen, 1996), and behavioral expertise (Crews & Boutcher, 1986; Jackson, 2003; Jackson & Baker, 2001). As such, interference in information processing may have negative implications for the quality and consistency of the pre-shot routine, especially in golf (Kirschenbaum & Bale, 1980; Rotella & Bunker, 1981).

During a pre-shot routine in golf, task-relevant information (e.g., green reading, trajectory, choice of club, stance, grip, emotional state) is systematically processed by the golfer. The chosen strategy for how to execute the golf task at hand is based on the collected information during this period. Critical levels of arousal can potentially impede attentional processes that encode task-relevant cues, and therefore compromise the quality and quantity of information that is processed. More specifically, elevated arousal and anxiety levels have been linked to a narrowing effect of attentional width, which is associated with the exclusion of task-relevant information (Easterbrook, 1959; Janelle, Singer, & Williams, 1999; Landers, Wang, & Courtet, 1985). Furthermore, higher levels of anxiety have also been associated with increased task-irrelevant thoughts (Eysenck et al., 2007; Wine, 1971). In this way, high levels of anxiety can create erroneous information processing by missing task-relevant cues (e.g., wind direction, breaks on the putting green, position of course obstacles), which consequently increases the probability of poor decision-making as to how the skill should be executed. Moreover, a decrease in temporal (i.e., time sequences) and behavioral (i.e., green reading, number of rehearsal strokes) consistency of a pre-shot routine may result due to the changes in information processing caused by non-optimal levels of arousal. The resulting inconsistencies in the PPR are likely to be idiosyncratic in nature with each athlete being influenced in a different manner. For example, increased distractions and focus on task-irrelevant information may lead to temporally longer routine times for some, whereas shorter routine times may result from rushing or skipping over more relevant sources of information.

To date, no studies have systematically examined the influence of specific arousal levels on the consistency of PPR. Such insights may help illuminate strategies and interventions for maintaining routine consistency under non-optimal arousal states. Therefore, the current study examined the influence of various arousal states on the behavioral and temporal consistency of performance routines (both pre- and post-routines) during golf performance. Specifically, we present a case study of three skilled golfers over the course of three competitive rounds. During the rounds, the golfers' arousal states were recorded and tracked along with their performance outcomes in order to determine their individual arousal-related performance zones (IAPZ; see Kamata et al., 2002). According to Kamata et al., the probability of optimal and non-optimal performance varies related to the arousal state of the athlete. Specifically, using Kamata et al.'s (2002) methodology, we determined each golfer's arousal state associated with poor, moderate, and optimal performance. We hypothesized that each golfer would reveal distinguishable and idiosyncratic IAPZs (i.e., poor, moderate, or optimal) associated with concomitant differences in both temporal and behavioral routine consistency.

1. Method

1.1. Participants

Volunteer participants ($N = 3$) were recruited from the men's varsity golf team at a major Division I university in the Southeastern United States during the Spring 2009 season. The participants were between 19 and 21 years of age. Each golfer reported a zero handicap, which represents a numerical measure of the golfers' playing ability. A handicap of zero represents the top one percent of the golfing population (Men's USGA Handicap Index Statistics, 2014). Their golf team was ranked in the top 20 at the National Collegiate Athletic Association (NCAA) level.