

Pre-Performance Routines among Club Volleyball Players: The Relationship between
Routines and Accuracy in Serving

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Dedication

Completing this project has been an incredible experience and one that I would not have been able to complete on my own. There are many people to thank in helping me to get here. First, thank you to men and women who participated in my study. My thesis would not have been possible without you. Next, my advisor Dr. Lewis, your patience and guidance made what can be an intimidating experience, instead one that was exciting and engaging. To my entire committee, Drs. Wiese-Bjornstal, Kraus, and Lewis, I greatly appreciate your time and sharing your expertise with me. Guidance from leaders like you has heightened my passion for beginning a career in sport psychology. And especially to Dr. Kraus, I never thought that what started as a consulting relationship in high school would turn into a career and lifelong mentorship and friendship. Thank you so much for your amazing influence in my life.

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Abstract

Pre-performance routines (PPR) have been shown to enhance athletes' abilities to concentrate on the skill at hand, control arousal levels, and improve performance. Current research on PPRs has examined a small variety of sports, most notably basketball and golf, in the context of closed skill execution. Furthermore, a majority of studies have examined PPRs at practice or scrimmage situations. The purpose of the current study was to examine the relationship between PPRs and the closed skill of serving in volleyball during competition. Gender differences and the relationship between PPRs and competitive anxiety (CA) was also explored. Participants were recruited from two club volleyball organizations at an NCAA Division I university in the Midwestern United States. Video recording were taken of each participant's behaviors prior to completing a serve at regional intercollegiate tournaments to assess PPRs. Additionally, two versions of the Competitive State Anxiety Scale II- directional (CSAI-2(d)) were administered to evaluate the relationship between PPRs and CA. Results indicated that there was no effect of PPRs on serving accuracy. In regard to CA, there was no relationship between CA and PPR maintenance. Women demonstrated a higher maintenance of behavioral serve PPRs, though their serving percentage was not statistically different from the men. These findings indicate that the use of strict PPRs, though effective in some sports, may not have the same effectiveness across sports. Additional research is needed to assess the effectiveness of PPRs on closed skill accuracy for other sports.

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Introduction

According to sport psychology researchers, routines help prepare athletes to complete a set of automatic skills despite variations in the sporting context (McCann, 2008; Taylor, 2012; Wrisberg & Pein, 1992). The variations of a sporting context include the actions of competitors, environmental conditions, referees, coaches, and internal biopsychosocial factors (Taylor, 2012). An athlete's inclusion of a routine helps to further routinize skill performance and enhances an athlete's ability to reach their optimal performance level (Foster, Weigand, & Baines, 2006; Lidor, 2007). According to McCann (2008), there are a number of reasons why routines are important in helping athletes improve their performance. Specifically, routines increase a sense of familiarity even in widely different environments, enhance feelings of confidence and control, help the brain focus on what is important, and reduce the need for over thinking or "dumb mistakes." One of the signs of being an elite athlete is being able to perform sport specific, closed skills exactly the same way each time (Afremow, 2014). Athletes gain this sense of familiarity by spending countless hours honing their physical skills and tactical knowledge. This, in conjunction with a routine, helps athletes to create a means of competing in their sports with the highest likelihood of reaching their optimal level of performance.

Many athletes use pre-performance routines (PPR) during competition to help improve performance (Bell, Cox, & Finch, 2010; Boutcher & Zinsser, 1990; Thomas & Over, 1994). PPRs involve an athlete focusing solely on a specific sequence of pre-established and rehearsed cues prior to a sport specific, closed skill (e.g., a punt in football or soccer, batting stance in baseball; Wrisberg & Pein, 1992). Taylor (2012)

explains that, “routines enable athletes to be completely physically, technically, tactically, and mentally ready to perform their best (para. 1).” PPRs should include both cognitive and behavioral components (Cotterill, 2011) that are completed the same way every time a closed skill is attempted. Similarly, the consistency of the timing of the PPR itself has been shown to influence skill accuracy (Wrisberg & Pein, 1992). This entire process is essential in sport as it centers on the ability to perform certain skills, actions, and tactical strategies to the utmost precision, which necessitates the simultaneous need to minimize error.

As noted above, athletes use PPRs to feel both physically and mentally ready to perform. However, there is little known about the relationship between PPRs and competition anxiety (CA), which encompasses both cognitive and somatic anxiety. The findings of Jones and Hanton (2001) showed that viewing CA as debilitating resulted in fewer positive thoughts. However, Mesagno and Mullane-Grant (2010) demonstrated that PPRs can improve performance even though state anxiety is present.

Similar to the area of CA, few studies have examined potential gender differences in the use, maintenance, and effectiveness of PPRs (Czech et al., 2004; Wrisberg & Pein, 1992). This is especially noteworthy to understand in volleyball due to gender disparity in access to the sport. The National Federation of State High School Associations’ (NFHS) 2012 report showed that volleyball was the third most participated in sport for girls with an estimated 418,903 girls participating at the interscholastic level. Volleyball was not even in the top ten most participated in sports for boys (as cited in Wiese-Bjornstal, 2013). Women may be stricter maintainers of a serve PPR due to more

coaching and playing opportunities available for them. Any gender differences in PPRs could be influential in how coaches and players utilize such routines.

Previous research indicates that PPRs are effective for improving performance (Schmidt & Pepper, 1998; Weinberg & Gould, 2003); however, many studies have focused on basketball and golf (Bell, Cox, & Finch, 2010; Czech, Ploszay, & Burke, 2004; Lonsdale & Tam, 2008). PPRs in volleyball have been examined in a few studies (Kolscher, 1984; Lidor & Mayan, 2005; Velentzas, Heinen, Tenenbaum, & Schack, 2010); however, these studies were limited by very small sample sizes, the examination of only one gender, and the failure to examine the association between PPRs and accuracy.

The current study builds on previous research by examining the relationship between PPRs and serving accuracy in volleyball. Specifically, this study extends previous research by including a larger sample size, both genders, various ages, and varying experience levels. This study also addresses the need for more studies examining PPRs in competition rather than scrimmages or practices (Bell, Cox, & Finch, 2010). Although PPRs are recommended to include both cognitive and behavioral components, this study will focus only on the behavioral components.

Specific Aims and Hypotheses

Primary aim. To examine the relationship between the use of a behavioral serve PPR and serving accuracy among collegiate club volleyball players.

Related hypothesis. Maintainers of PPRs will exhibit higher serving accuracy than non-maintainers of PPRs.

Secondary aim. To examine the relationship between PPRs and competitive anxiety (CA).

Related hypothesis. Maintainers of PPRs will exhibit lower levels of CA than non-maintainers of PPRs.

Tertiary aim. To examine gender contrasts in the use of PPRs.

Related hypothesis. Females will be more likely to use PPRs than males.

Literature Review

The following review of literature will begin with an overview of the more prominent processes and tools used by sport psychologists to improve sport performance. While the following review seeks to specifically explore PPRs, other tools (e.g. imagery, self-talk, and goal setting; Robazza & Bortoli, 1998) will be discussed in order to better understand PPRs in the context of other effective mental training tools. The final sections will then summarize the PPR literature including: Developing PPRs, PPR effectiveness, the relationship between PPRs, CA, and performance, and gender differences in PPR use.

General Sport Psychology Tools

The field of sport psychology centers around the understanding that everything an athlete feels, does, and thinks can influence his or her performance (Vealey, 2005). This is often described as the ABC's (e.g. affect, behavior, and cognition; Illinois State University, n.d.) of sport psychology. Each of these pieces sit along a circular path, such that each one has the ability to inform and influence the others. Thus, a sport psychology professional can use this interdependence to aid athletes in elevating their performance (e.g., improving cognitions will improve thoughts and then behaviors). The techniques utilized in the field thus follow this circular understanding and aim to improve one or two

pieces of the circle as a means to then influence the remaining piece(s). Commonly used techniques include imagery, self-talk, and goal setting.

Imagery. Imagery is the ability to rehearse events, specifically sporting events, in one's mind (AASP, n.d.). Morris et al. (2005) define imagery as:

... the creation or re-creation of an experience generated from memorial information, involving quasi-sensorial, quasi-perceptual, and quasi-affective characteristics, that is under the volitional control of the imager and which may occur in the absence of the real stimulus antecedents normally associated with the actual experience. (as cited in Morris, 2013, p. 482).

This involves using all of the senses (i.e. see, feel, touch, sound, smell, and taste) in order to create the most realistic depiction of an event and one's thoughts, feelings, and actions within that setting. Imagery is also known as visualization or mental rehearsal (AASP, n.d.). There are five main functions or purposes of imagery, which include cognitive general (CG; images of specific plays), cognitive specific (CS; images of sport specific, technical skills), motivational specific (MS; images related to personal goals), motivational general-arousal (MG-A; images related to arousal, stress, or anxiety), and motivational general-mastery (MG-M; images of self-confidence, being tough, or images of control (Munroe-Chandler, Hall, Fishburne, Murphy, & Hall, 2012).

Cognitive specific (CS) imagery have been shown to be effective for both adult's (Martin, Moritz, & Hall, 1999; Morris, Spittle, & Watt, 2005) and children's (Li-Wei, Qi-Wei, Orlick, & Zitzelsberger, 1992) skill acquisition and performance. For example, in a study on CS imagery, Munroe-Chandler et al. (2005) examined its potential effectiveness on the speed and accuracy of soccer skill performance among a sample of elite youth

soccer players. They randomly counter-balanced sixteen teams into a CS imagery condition or a motivational general-arousal (MG-A) imagery condition, which functioned as the control. At the end of the six-week intervention, they found that those participants in CS imagery group performed better in the soccer skills, but only those in the CS imagery group in the seven to eight-year-old age bracket reported increased use of CS imagery, while no participants in the MG-A imagery control group reported increased MG-A imagery use. Munroe-Chandler et al. recommended that mental skills such as imagery should be introduced to younger athletes as they may be more willing to embrace and use the skills to their advantage.

Mellalieu, Hanton, and Thomas (2009) studied the use of a motivational general-arousal (MG-A) intervention with a sample of male rugby players to assess its effects on pre-competitive symptoms (e.g. competitive anxiety, self-confidence). They found that while there was no change in the intensity of the precompetitive symptoms, there was a shift in athletes' interpretation of the symptoms. Such that they viewed the same emotions differently and ultimately found them to be more facilitative in feeling ready for competition as opposed to feeling nervous and anxious. The rugby players also reported greater feelings of self-confidence than at baseline. Mellalieu et al. (2009) assert that a MG-A imagery intervention can be effective in reducing the debilitating interpretations of symptoms, but cautions that reducing the symptoms themselves may negatively affect performance given that many sports require high levels of activation and arousal for optimal task performance. It is how athletes interpret the pre-competitive symptoms that create either positive or negative affective states. Coelho et al. (2008) found that young tennis players given imagery and technical training performed better in "serving without

precision” than peers who only received technical training. However, there was no significant between group differences when asked to “serve with precision.” Coelho et al. (2008) concluded that although imagery is reliable for improving serve performance, there is a need to use imagery in very specific ways. However, this should vary by situation and the desired outcome and predominantly should be used in situations that call for the enhancement of performance-related issues.

There are many different types of imagery and as explained above their use and effectiveness should vary across situations. Imagery covers a broad range of possible types of images and has been shown to be effective in regard to competitive anxiety, self-confidence, and performance. The next section will cover another widely used sport psychology technique, self-talk.

Self-talk. Self-talk (ST) was described by Hardy, Hall, and Hardy (2005) as a, “multidimensional phenomenon concerned with athletes’ verbalizations that are addressed to themselves” (p. 905). This inner speech allows individuals to silently verbalize feelings, perceptions, and regulate thoughts, and instruct and reinforce themselves (Hackfort & Schwenkmezger, 1993). ST has been categorized as either positive or negative and either instructional or motivational (Tod, Hardy, & Oliver, 2011). Traditional sport psychology has predominantly emphasized the effectiveness of positive ST, while simultaneously expecting negative ST to detrimentally affect performance (Zinsser, Bunker, & Williams, 2010). Conversely, work by the Theodorakis, Weinberg, Natsis, Douma, and Kazakas (2000) argued instead that the type of ST should be matched with type of task. For example, instructional ST should be matched with more precision-focused tasks, but motivational ST would be more effective for tasks

requiring strength and conditioning. Theodorakis et al. (2000) found support for their task-matching hypothesis among young novice basketball players, such that motivational ST was perceived as helpful during the task of shooting. These findings have been confirmed in subsequent studies (e.g., water polo; Hatzigeorgiadis, Theodorakis, & Zourbanos, 2004).

A systematic review by Tod, Hardy, and Oliver (2011) outlined 47 articles on ST and its mediating and moderating factors. Although positive ST was found to positively affect performance, there was no support for the concept that negative ST is detrimental to performance; in fact no effect was detected. Tod et al. (2011) then divided articles based on the matching hypothesis prescribed by Theodorakis et al. (2000), discussed above, and found that in regard to precision-based tasks, both motivational and instructional ST positively affected performance. Similar results were revealed when reviewing studies on gross motor skills. According to Tod et al., the review indicated that there is substantial evidence to support the beneficial effects of ST in the areas of cognition, skill execution, self-esteem, and cognitive anxiety

Research has also shown that athletes report utility in their usage of ST, especially with attention-based outcomes (e.g. concentration; Chroni, Perkos, & Theodorakis, 2007). Furthermore, manipulating ST is effective in shifting attentional focus (Bell & Hardy, 2009) and reducing inhibiting thoughts (Hatzigeorgiadis, Theodorakis, & Zourbanos, 2004). In regard to self-esteem (SE), Wood, Perunovic, and Lee (2009) examined individuals with both high and low self-esteem and randomly assigned them to one of two conditions: Repeating positive ST statements or a no-statement control. They found that those participants assigned to repeat positive ST statements who had initially

reported low SE, reported even lower SE at post-test after positive statements such as, “I’m a lovable person.” Furthermore, this same group reported lower feelings of SE than participants who had similarly reported low SE at baseline, but were assigned to the no-statement control. Only limited benefits were found among the participants who reported high initial SE and were asked to repeat positive ST statements. Wood et al. concluded that positive ST may produce benefits for certain people, but are not necessarily effective for those who might otherwise *appear* to benefit from them. Additionally, Conroy and Metzler (2004) asserted that ST lies at the center of anxiety. Kendall and Treadwell (2007) found that the reduction of negative or anxiously-oriented ST resulted in less anxious states. Similar to the matching hypothesis of Theodorakis et al. (2000), evidence on anxiety highlights the importance of matching treatment modalities to where anxiety is most felt (i.e. using body treatments for somatic anxiety; Maynard, Warwick-Evans, & Smith, 1995).

The internal focus of ST has the potential to effect other internally focused constructs, such as competitive anxiety and SE, which can translate to improved performance. However, the evidence above suggests that it is particularly important for the type of ST to match both the individual and performance task to be effective. The following section on goal setting will complete the overview of psychological tools.

Goal setting. Hardy et al. (1996) stated that goal setting is fundamental for maximizing athletic performance. Locke and Latham (1990) described goals as motivational strategies that direct a number of important aspects of effective performance including growing effort and intensity, narrowing attention, boosting persistence in the

face of adversity, and developing problem solving skills (as cited in Roberts & Kristiansen, 2013, p. 491).

Bowyer, Koslow, McMillin, Wenos, and Vedelli (2000) studied goal setting in a sample of Division I wrestlers. Across the 12-week study, wrestlers were first provided a wrestling specific goal setting intervention and continued to report on self-confidence on a weekly basis. Results showed that while self-confidence levels changed from week to week, there were no differences from pre- to post-competition. Bowyer et al. (2000) recommended that the combination of weekly and more long-term or season-long goals might lead to greater increases in self-confidence and ultimately higher performance levels. Luppani and Stillwell (2000) found that among successful collegiate women's basketball coaches, two goal setting themes emerged: A commitment to winning and goal congruency. Goal congruency refers to both short-term goals and individual goals leading to and providing clear paths to long-term goals. The findings show that goal setting processes of successful coaches were clearly defined, aimed at empowerment, and used various types of feedback (Luppani & Stillwell, 2000).

In regard to mediating factors influencing the effectiveness of goal setting, Bueno, Weinberg, Fernandez-Castro, and Capdevila (2008) found that both emotional and motivational mechanisms were influential mediators. In a sample of 35 male endurance athletes, Bueno et al. (2008) assigned participants to four different experimental conditions including a goal (attainable or not) and a means of social comparison (win or lose). They found that athletes who had high self-efficacy (SE) also maintained a higher sense of motivation in pursuing goals, whereas athletes with lower SE perceived difficult goals as unattainable or threatening, which could lead to feelings of incompetence or

helplessness. A systematic review of goal setting as a means to health behavior change by Pearson (2012) also found promising effects in working with overweight or obese adults. However, many of the studies reviewed utilized concurrent interventions so identifying the specific results of the goal setting in that environment are uncertain.

Through this understanding of sport psychology tools, the discussion will now center solely on pre-performance routines (PPRs) and why and how they have become an essential aspect of competition. The discussion above forms the foundation from which we can understand PPRs' role in sport and how such tools can best be manipulated to improve performance. The use of routines abounds in sport, among athletes, coaches and even fans.

Routines in Sport

Outside the realm of sport psychology, but within the world of sport, well known routine examples from among elite athletes include: Michael Jordan who wore his old North Carolina Tar Heels shorts under his Bulls uniform, Turk Wendell, a pitcher in Major League Baseball (MLB) in the 1990s, who brushed his teeth and chewed licorice between innings and MLB All-Star shortstop Nomar Garciaparra, who got dressed in exactly the same way for every game (Morrison, 2007). National Football League player, Shaun Phillips, described his detailed game day routine as critically strict. His routine includes getting ready in a certain order and putting x's over the faces of his opponents in the game day magazine (Stack.com, 2007). His reason for such strict maintenance throughout college and into his professional career is that it has kept him healthy and it has just become something he does. He does also state that his routine is his "superstition" (Stack.com, 2007). Sport fans also use routines. Baseball fans turn their

hats inside out and backwards to rally their team to victory. Basketball fans hold their fingers up and remain quiet when one of their team members is shooting a free throw.

The above examples indicate that there are blurred lines between routines and what is simply superstition. According to sport psychology professionals, routines can be used in a variety of ways in the realm of sport. They can be used before and during practice, both pre- and post-competition, and during competition. The overarching aim of a routine, regardless of when and where it is used, is to prepare an athlete to control their performance as much as possible (Taylor, 2012). Taylor recommended that athletes begin to use routines in practice, as that is where the majority of training occurs. In regard to routines used prior to competition, Taylor further described two dimensions that an individual should consider in order to form a good routine including focus style (can be either internally or externally centered) and ideal intensity level (can be high or low). Neither of these focus styles were present in the examples from elite athletes included above. Both the focus style and intensity level should be adjusted to an individual's ideal ABC's (i.e. affective, behavioral, and cognitive).

Coaches can be particularly influential in creating an environment that fosters effective routines. Bloom, Durand-Bush, and Salmela (1997) showed that elite coaches reported facilitating structured routines for their athletes. For pre-game, this includes having the team arrive together, engage in a standard set of locker room activities, and participate in a comprehensive warm-up together (Bloom et al., 1997; Martens, 1987). McCann (2008) believes that one of the most basic facets of sport is teaching athletes to cultivate great routines, which forms the foundation of a coach's work in developing athletes. More anecdotally based evidence similarly points to the role of the coach in

establishing routines. Lifeletics (2013) noted that the time before a game is important, especially for kids, because it gets the players ready to focus on the game both physically and mentally. They recommend having a set routine for the players and coaches to “maximize attention” (Lifeletics, 2013).

Beyond what coaches do for their athletes, they even have their own version of routines for themselves. As mentioned above, Bloom et al. (1997) examined the use of routines by expert coaches. Through in-depth, open-ended interviews, they analyzed the routines by both the athletes and coaches. Examples of routines included taking time to be alone the morning of competition, mental rehearsal of the game plan, arriving early to the competition site and keeping themselves busy with tactical and game prep details during the warm-up (Bloom et al., 1997). When dealing directly with the team in the final minutes before the game, Bloom et al. found that the elite coaches refrained from a “pep talk” because of their intimate knowledge of the individuals on the team, realizing that varying arousal levels would make such a talk inappropriate for many players. Their talks instead focused on stressing the most important points of the game’s preparation. Furthermore, questions regarding post-game situations indicated that coaches found meaning in routines. Coaches reported that they said very little after the game because the athletes were not receptive. Instead, they waited until the next practice to discuss the game in order to give the players time to process the game. The findings in this study mirror those of many others specifically examining coaches’ routines (Cox, 1994; Martens, 1987; Orlick, 1986). Similarly, Bell (1997) explained that routines help expert teachers or coaches in their daily teaching or coaching. It is the use of routines, which as repetitive actions, develop so that they can occur with “little planning, practice or

forethought” (Bell, 1997, p. 37), which, as Bell points out, is why novice coaches can fail to accomplish tasks if they lack routines.

As the examples above describe, many athletes and those who support them use routines. Although they have the potential to be used superstitiously, research shows that when used in certain ways they can be effective in improving performance (Bell, 1997; Bloom et al., 1997; Taylor, 2012). In addition to routines used pre- or post-competition, there are also routines used within competition itself known as a pre-performance routine (PPR), which is the most heavily researched type of routine. Moran (1996) expounds that PPRs are, “a sequence of task-relevant thoughts and actions which an athlete engages in systematically prior to his or her performance of a specific sports skill” (p. 177). PPRs are used by athletes and other types of performers to increase concentration through focusing on the task-relevant cues, to overcome any susceptibility to dwell on negative thoughts, aid in the selection of appropriate performance behaviors, and prevent undue attention to the mechanics of an automatic skill (Cotterill, 2011).

Moreover, PPRs have been shown to focus attention, minimize distractions, reduce anxiety, improve confidence, and help with mental preparation for upcoming performances (Lidor & Singer, 2000; Weinberg & Gould, 2003). Principally, PPRs support athletes in focusing exclusively on a series of well-rehearsed cues, which in turn reduces the athlete’s tendency to dwell on potentially damaging thoughts, such as winning or losing, negative evaluations of self or self-efficacy, or physically performing the actions themselves (Boutcher & Crews, 1987). PPRs are recommended to include both task-relevant thoughts and task-relevant actions. Utilizing both thoughts and actions helps to maximize the benefits of a PPR (Boutcher, 1992). To delve specifically into

PPRs, the next sections will detail how PPRs are developed and utilized in sport, what is known about their effectiveness (behaviorally and temporally), gender differences in the use of PPRs, and how PPRs affect the relationship between competitive anxiety and performance.

Developing pre-performance routines (PPRs). The goal of sport psychology is to create interventions that improve sport performance. PPRs can be a crucial piece of reaching optimal performance (Foster et al., 2006; Lidor, 2007). Robazza and Bortoli (1998) note that tools like stress management, focus, positive self-talk, imagery and motivation are useful in creating good sport psychology interventions. These tools are all used in varying degrees within PPRs. PPRs form a bridge between the physical, mental, and tactical components of sport (Schack, Whitmarsh, Pike, & Redden, 2005), which allows for the utilization of a number of cognitive and behavioral tools (Moran, 1996; Singer, 2002; Velentzas, Heinen, Tenenbaum, & Schack, 2010; Wrisberg & Anshel, 1989).

PPRs aid athletes in focusing their thoughts solely on a specific set of well-rehearsed cues while simultaneously limiting the amount of mental capacity available for worrying about the outcome of the contest, having negative estimations of self, or the physical actions of the performance (Boutcher & Crews, 1987). Cotterill (2011) notes that there are two very clear components of an effective PPR: Task-relevant thoughts and task-relevant actions. The inclusion of both pieces in building a PPR maximizes an athlete's ability to obtain the benefits of a PPR, such as improving concentration, overcoming any tendencies to dwell on negative thoughts, and self-selecting performance thoughts and behaviors (Boutcher, 1992). The thoughts or cognitive component of a PPR

could include tools such as self-talk (Bunker & Owens, 1985; Bunker & Rotella, 1982), cue words (Boutcher, 1990; Lidor, 2009), or imagery (Guillot & Collet, 2005; Mahoney & Avener, 1977). Examples of behavioral components include practice attempts (e.g., golf swings, field goal kicks) or some type of rhythmic movement (e.g., ball bounces in basketball, volleyball, or tennis or knee bends and arm swings in diving; Velentzas et al., 2010). With both of these pieces combined, a PPR for a tennis player's serve could be two bounces of the ball with the non-racquet hand, three quick hits of the ball with the racquet, a deep breath, then tossing the ball into the air and thinking the mental cue word "pow" just before swinging through the serve. Research indicates that including both of these components, behavioral and cognitive, is effective in improving performance (Cotterill, 2011; Czech, Ploszay, & Burke, 2004; Lidor, 2009; Lidor & Mayan, 2005).

In order to better design routines for athletes, there are a number of tools available to not only build, but also examine routines. In order to examine the behavioral component of PPRs, videotaping and performance observations are often used for analysis (Velentzas et al., 2010). Interviews or self-report measures are commonly used to look at the cognitive component (Lidor, 2007). Cotterill (2011) sought to look at both of these components and research the challenges of implementing effective routines with professional cricket players. With the aid of a professional consultant, the study worked with athletes to build individualized PPRs through a number of developmental steps (i.e., videotaping performance, developing focus and function, practice), as recommended by the previous work of Cotterill, Sanders, and Collins (2010). Cotterill (2011) found that the athletes were very receptive and reported growing comfortable with their routines after six weeks of practice.

Researchers have also examined the when and how of routine integration.

Heishman (1989) found that it was more beneficial to integrate routines after the basic skill has been learned as opposed to including a routine simultaneously with learning a new skill. In regard to how to best integrate routines, Velentzas, Heinen, Tenenbaum, and Schack (2011) compared one group who learned how to integrate imagery into a routine and another who was given an introduction to what routines are, which functioned as the control group. In a population of volleyball players, they found that the imagery routine group had significant performance enhancement that was retained at the three-week follow-up compared to the control. In similar research on imagery use in routines, Schack and Mechsner (2006) showed that imagery can affect both the structure of a specific movement (behavioral) and the psychological state of the athlete (cognitive), which matches with the two components proposed as ideal pieces of an effective PPR. While this is not an exhaustive list of the ways in which PPRs can be developed and utilized, it does provide a basic understanding of the process. More crucial for the current discussion is an intimate understanding of why it is useful to use PPRs. The next section will examine evidence regarding the effectiveness of PPRs and their ability to optimize performance.

PPR effectiveness. Athletes are notorious in their use of PPRs (Lidor & Singer, 2003). For example, Kevin Pangos, current point guard for the Gonzaga University Bulldogs, has a very distinct free throw routine. After a deep breathe he pops the ball behind his head with both hands, dribbles two times, spins the ball in his hand, dribbles one more time, takes another deep breathe and shoots (ESPN2, 2014). Logan Tom, long time member of the USA Women's Volleyball team, has had the same serving routine for

the majority of her career, which includes spinning the ball twice and letting it bounce, then three quick bounces close to the ground, a spin of the ball in her hands, then two steps as she throws the ball one-handed into the air and then runs and jumps into her topspin jump serve (Vlyblloea, 2011). Pangos and Tom both have well-known, highly consistent PPRs. They are highlighted because their PPRs demonstrate the overall potential of PPRs' effectiveness. Pangos' shooting percentage of 92% was sixth best during the 2013-2014 NCAA season (ESPN, 2013). As a four-time Olympian, Tom has been named "best server" at international events three different times across nearly a decade (Oden, 2012).

In working with Olympic athletes, sport psychology professionals insist that athletes stick to their PPRs. During the 2014 winter Olympics in Sochi, Afremow (2014) recommended that athletes keep in mind that the physical task is always the same, no matter the environment, but that maintaining their routines will help them slow things down as they get nervous and find themselves rushing. Beyond anecdotes and recommendations, there is a large pool of research on PPRs and their effect on performance. Two major pieces typically studied in relation to PPRs and performance include both the behavioral and temporal consistency of the PPR, which is then compared to the rate of success in performing the skill (Lonsdale & Tam, 2008). These pieces do not; however, cover both the cognitive and behavioral aspects needed in a PPR as discussed above. Far more research has been dedicated to the behavioral piece, which can be evaluated through many different methods (i.e., self-report, videotaping and direct observations) as opposed to only one method (i.e., self-report) for the cognitive aspect (Lonsdale & Tam, 2008). Research findings on behavioral consistency are presented first.

In a study on two elite cricket players by Cotterill (2011), mentioned above, athletes worked with a sport psychologist to further develop their PPRs. The athletes reported that the PPRs were beneficial for successfully executing their cricketing skills. However, there were no specifics given regarding what skills improved or how much they were affected. Thomas and Over (1994) looked at club golfers and found a significant correlation between handicap and the golfers' self-reports of routine consistency. Boutcher and Zinsser (1990) showed that pre-putt patterns were used 62% of the time among elite golfers, but only 35% of the time among beginners. Czech, Ploszay, and Burke (2004) examined free throw PPRs in a sample of collegiate basketball players. They found that those who strictly maintained a PPR were not statistically different from those who did not. However, the PPR maintainers did have an overall higher free throw percentage (74%) than the non-maintainers (68%). Lonsdale and Tam (2008) also examined free throw PPRs, but in NBA players. They found that adherence to a dominant PPR was related to greater free throw accuracy. They also noted that beyond the statistical significance, the findings were particularly meaningful for games given the 12.43% difference in free throw accuracy translated to 3.55 points (Lonsdale & Tam).

Temporal consistency is also important for PPRs' effectiveness. Some research supports the need for strict consistency, while contrasting research suggests that time allowances do not affect performance. In a sample of collegiate basketball players, Wrisberg and Pein (1992) evaluated the relationship between a player's PPR in free throw shooting and their success at the line. They found that the more successful players showed greater temporal consistency. Conversely, Southard and Miracle (1993) manipulated free throw duration in a sample of eight college basketball players and found

that there were no significant differences in accuracy whether PPRs were allowed to maintain a normal pace or were manipulated to be half-time or double-time. Lonsdale and Tam (2008) also discussed above in regard to behavioral consistency, found that temporal consistency was not associated with accurate free throw execution among NBA players. Furthermore, research by Jackson (2003) found in elite rugby players that there were no differences between the best and worst kickers in total PPR time, temporal consistency of PPR, or PPR rhythmicity. He did find that longer concentration time and physical preparation time were both strongly influenced by the overall difficulty of the kick and to a lesser degree what he defined as “situational pressure” as determined by the score.

Outside the realm of sport, but in the similar area of performing arts, there is comparable research that suggests PPRs are effective in improving performance. In a study of junior high age singers, Broomhead, Skidmore, Eggett, and Mills (2012) found that using a positive mindset trigger word in a PPR improved the singers’ expressivity. In piano players, Schmidt (1982) found that when elite players gave mental energy specifically to hand movements while playing, it detracted from their overall performance. This is a problem that a PPR could solve by gearing energy toward focusing on the task, while not dwelling on the technical requirements.

The current findings on the effectiveness of PPRs indicate that PPRs appear to be influential in performance outcomes for a variety of athletes in a number of sports. They can minimize external distractions (Boutcher & Crews, 1987) and help control nervousness (Afremow, 2014), which has the potential to lead to better performances (Boutcher & Zinsser, 1990; Broomhead et al., 2012; Lonsdale & Tam, 2008; Thomas & Over, 1994). However, it is yet unclear how influential behavioral and temporal

consistency are in overall performance. Especially given the cross-sectional design of many of these studies, it is difficult to assess a causal link between the use of a PPR and successful performance. Additionally, it is important to examine how various factors, such as competitive anxiety, may influence the use and effectiveness of PPRs.

Competitive anxiety, performance, and PPRs. The world of sport is one of contest and competition, which often elevates arousal and emotional levels. These elevated levels can frequently lead to competition anxiety (CA). CA is an emotional state or reaction characterized by a combination of feelings of intensity, apprehension, preoccupation, and mood disturbance (Spielberger, 1975). CA is typically felt in the weeks, days, and hours preceding an important competitive event (Vealey, 1990). Eysenck, Derakshan, Santos, and Calvo (2007) stated that CA has the potential to shift attention from being goal-directed to being stimulus-driven. This can increase the use of attentional resources toward threat-related stimuli while simultaneously decreasing the attention given to the task itself. All athletes must learn how to cope with this internal state to maintain their ability to perform the physical and mental skills required. Singer (2002) asserted that one of PPRs' most important functions is to aid athletes in self-regulation, especially as it relates to arousal level, attentional focus, cognitions, and performance expectations, which is important when completing self-paced, closed or semi-closed skills. Weinberg and Gould (2007) also demonstrated that PPRs can help to structure thoughts and emotional states during competition. However, there is little evidence available that specifically describes PPRs' ability to affect the relationship between CA and performance, even though CA is a heavily researched area. Therefore, this section will first discuss general evidence on CA and its effect on performance

followed by what is directly known about CA, performance and PPRs. Included throughout will be the prospective links that can be drawn from what is currently known about CA and other sport psychology tools and how these relate to the importance of PPRs.

In regard to CA and arousal in general, Arent and Landers (2003) investigated arousal and the inverted-u hypothesis (i.e. as arousal reaches the extremes, low or high, performance will decline accordingly) in a laboratory setting. They found that arousal explained much of the variance in performance including reaction time (RT) and simple response time (SRT), 13.2% and 14.8% respectively. This suggests that PPRs' promotion of strict habitualness, both behaviorally and cognitively, would help further the experience of less intense and fewer detrimental emotions. These findings can be linked to those of Jones and Hanton (2001) on pre-competitive feeling states and directional anxiety interpretations. They found that the individuals who self-assigned themselves as being facilitated by feelings of CA before competition reported significantly more positive associations of those feelings than those who self-assigned as being debilitated by similar feelings. The individuals were essentially experiencing the same feelings, but they were interpreting them differently on an individual basis, such that some found them to be beneficial while others found them malignant. PPRs can improve performance even though state anxiety is present, as shown in a study by Mesagno and Mullane-Grant (2010), discussed in detail below, potentially transforming the debilitators into facilitators.

PPRs are influential in the emotional and cognitive regulation related to choking under pressure. Mesagno and Mullane-Grant (2010) defined choking as the, "critical

deterioration in skill execution leading to substandard performance that is caused by an elevation in anxiety levels under perceived pressure at a time when successful outcome is normally attainable by the athlete (p. 343).” Mesagno, Marchant, and Morris (2008) researched what PPRs could do to ameliorate anxiety levels and reduce choking. In a single-case design study, they trained athletes on a number of PPR components (e.g., deep breathing, cue words). They found that the PPR improved performance an average of 29% for all three participants in high-pressure situations compared to similar situations prior to developing a PPR.

Additionally, Mesagno and Mullane-Grant (2010) examined PPRs in 60 experienced Australian football players as they attempted 20 kicks in both low- and high-pressure phases. After completing the low-pressure phase, but before attempting the high-pressure phase, participants received training in one of following five groups: Extensive PPR, deep breath, cue word, temporal consistency, or pressure control. The participants then completed the high-pressure phase. Mesagno and Mullane-Grant assessed three different aspects of the footballers’ performance including anxiety (measured using a revised version of the Competitive State Anxiety Inventory-2; CSAI-2R), success or failure of the shot, and PPR completion time consistency. Mesagno and Mullane-Grant’s findings indicated that state anxiety increased during the high-pressure phase for all participants. However, those in the various intervention groups exhibited improved performance, while the control group experienced decreased performance.

Findings in other domains can also be helpful in drawing preliminary links between PPRs’ potential effect on overall performance anxiety. In regard to learned behaviors (i.e. well-honed athletic skills), Wood, Quinn, and Kashy (2002) linked

Frijda's laws of emotion with how the mode of performance and emotion will interact. One of Frijda's laws of emotions states that "continued pleasures were off; continued hardships lose their poignancy (as cited in Wood et al., 2002, p. 1283)." Wood et al. believe that this translates into less intense emotions being associated with habitual behaviors when compared to non-habitual behaviors. In addition, Wood et al. describe that because habit performance requires minimal direct thought, individuals can think of other things, which can be problematic if those thoughts are highly emotionally charged. This is demonstrated in Wood et al.'s findings that individuals, while completing habitual actions, often reported that their emotions were associated with their thoughts, regardless of their actions. In the sporting context, this has implications as skills become second nature and thoughts are freer to roam (e.g. the intensity of the moment, winning, embarrassment related to failing; Lidor & Singer, 2000; Weinberg & Gould, 2003). PPRs' focus on cognitions is ideal for structuring the thoughts around routinized actions that will result in productive emotions.

Furthermore, to draw additional links between PPRs and CA, it is possible to examine evidential support for a number of other sport psychological tools' influence on CA. The ability of PPRs to be molded to specific individuals and their competitive needs through the utilization of a variety of sport psychology tools makes PPRs an ideal tool when working on anxiety issues. Imagery is a widely used tool in working with individuals who have performance anxiety (Feltz & Landers, 1983; Murphy & Lowdy, 1992). As described above in the section on imagery, Mellieu, Hanton, and Thomas (2009) found changes in assessments and interpretations of CA among male rugby players using motivational general-arousal (MG-A) imagery, such that previously

negative interpretations of CA came to be viewed more positively and beneficial for performance as opposed to detrimental. Vadocz, Hall, and Moritz (1997) also found connections between imagery and CA. Specifically, they found that in a population of youth roller skaters, those who used more motivational general-arousal (MG-A) imagery had higher levels of competitive anxiety. Similar findings by Strachan and Munroe-Chandler (2006), showed MG-A to be a significant predictor of anxiety, but also of self-confidence in female baton-twirlers aged 7-11. In regard to self-talk interventions, Hatzigeorgiadis, Zourbanos, Mpoumpaki, and Theodorakis (2009) found that motivational self-talk also improved self-confidence while simultaneously reducing cognitive anxiety during performance.

In summary, while currently there is little research specifically examining the relationship between PPRs, CA, and performance, there are studies that have examined how PPRs influence the related topic of choking and performance. There is also research supporting the use of other common sport psychology tools such as imagery to help with CA. These tools have the potential to be integrated with PPRs. Further research is needed that examines the effect of PPRs on CA and performance.

Gender differences in PPRs. While the use of PPRs has been studied in a variety of sports (Bell, Cox, & Finch, 2010; Jackson, 2003; Lonsdale & Tam, 2008; Velentzas et al., 2010), there are few studies that have specifically examined gender differences. The two studies that have examined gender differences in the use and effectiveness of PPRs have yielded mixed results. For example, Wrisberg and Pein (1992) found no significant effect between gender and pre-shot interval in basketball players. However, Czech, Ploszay, and Burke's (2004) study of basketball players showed that a higher percentage

of men were PPR maintainers, defined as using their PPR 90% or more of the time. They found that eight out of nine for the men compared to three out of seven for the women qualified as maintainers.

The question of gender and PPRs is particularly interesting in the current sporting culture as the growth of female participants continues to expand. Since the passage of Title IX, the number of high school girls participating in sports in the United States has grown from 294,015 in 1971-1972 to more than 3.2 million in 2012-2013 (NFHS, 2013). This represents an expansion of more than 10 times the female participants in just over 40 years, a growth not matched by that of their male counterparts, who experienced growth of only 1½ times across the same time span. Any potential differences in how PPRs are used and their effectiveness among the genders would be highly relevant information for coaches and their players. More research is needed to ascertain whether PPRs differences exist among the genders.

Serve PPRs and volleyball. PPRs are used in the sport of volleyball and on the closed skill of serving (Kolscher, 1984; Lidor & Mayan, 2005; Velentzas, Heinen, Tenenbaum, & Schack, 2010). A serve in volleyball initiates each point of play and is therefore, an integral part of the game. Effective serves have the ability to minimize the offensive threat of the opponent, allowing for easier defensive plays, singling out weaker individual opponents, and scoring points on their own. Similar to a serve in tennis or a pitch in baseball, play cannot begin without a serve. But unique to volleyball, there are rule and environmental conditions that make a serve in volleyball very different from even similar closed skills in other sports.

A serve first requires the player to be in the right back position of the court and to be outside the court with the ball. From there, the player tosses the ball and hits it with one hand over the net to the team on the other side. Current international rules, as established by the Fédération Internationale de Volleyball (FIVB; 2012), dictate that when preparing to serve, the server may dribble the ball or move the ball in their hands, but only one toss of the ball is allowed. Once the ball is tossed, the server must hit the ball with one hand or any part of the arm from outside the court, which includes the end line. The server has 8 seconds after the referee's whistle to complete the serve (FIVB, 2012). The timing of the referee's whistle is at their discretion for the server's readiness to begin the serve. Service faults occur if the incorrect player serves out of order, players other than the server are out of order on the court at the time of the serve, the serve is not properly executed, if the ball does not cross over the plane of the net or does but lands outside the court, or the ball contacts one of the antennas which project vertically on either side of the net to designate the side line and is considered out of bounds (FIVB).

Environmentally, there can be a number of factors that can influence the server and their subsequent service attempt. Due to the requirement for players to exit the court to serve, players can be faced with distractions from spectators and fans. This area can be in close proximity to hostile or loud fans or even the movement of spectators around the court can be distracting. In many levels of play, the space around the court used for serving, though uniform in professional international play, often varies greatly from facility to facility. Players who typically require more space to complete their serve will have to make adjustments when spatial deviations dictate. The blowing of the whistle to begin the service itself also changes depending on the referee and what has transpired in

the previous play. Some referees will whistle as a server is receiving the ball or may wait several seconds to check that both teams are ready for the service. Substitutions and questions about calls can also delay a service.

All of these factors have the potential to result in disruptions or variations to a player's serve and any serve PPR they may use. Previous studies on PPRs and volleyball serves are limited by the assumption that positive results from PPR studies on other sports translate to volleyball. Due to all of the potential disruptions inherent in a volleyball serve, it is necessary to look directly at how players utilize serve PPRs and whether there is any relationship between a serve PPR and serving accuracy.

In order to investigate the serve PPR, the current study was modeled after a similar study done by Czech et al. (2004), discussed above in regard to PPR effectiveness and gender differences. They observed collegiate male and female basketball players at 10 intercollegiate basketball games (five men's and five women's) in order to assess the players' preshot routine prior to a free throw. Observations were made using a checklist to track each player's physical (i.e., behavior) actions and their free throw shooting accuracy. From this, Czech et al. (2004) sought to compare shooting percentages between those who maintained their preshot routine from shot one to shot two in a standard two-shot free throw attempt to those who changed from shot one to shot two. They defined maintaining as performing the exact same routine prior to each shot 90% or more of the time and non-maintaining as maintaining the routine 0-30% of the time. They found that while there was no statistical significance between the maintainers and the non-maintainers on free throw shooting percentage, the maintainers did have a higher overall average for their free throw accuracy (74% compared to 68%). Using Czech et al. (2004)

as a model, this study seeks to examine the effect of PPRs on serve accuracy in volleyball.

Summary and Conclusions

Sport psychology researchers and applied professionals utilize a number of processes and tools to guide athletes towards elevated performances (Foster et al., 2006; Lidor, 2007). Imagery brings scenes of play to the athlete's mind by using all of their senses to create a realistic scene in which they can practice seeing themselves being successful (AASP, n.d.; Morris, 2013). Self-talk provides internal verbalizations, which silently provide athletes with a means of talking themselves through different points in competition (Hardy, Hall, & Hardy, 2005). Goal setting provides focus, drive, and narrows attention toward meaningful accomplishments (Hardy et al., 1996; Roberts & Kristiansen, 2013). Within this landscape, PPRs are commonly used to infuse a variety of mental training tools in order to create structure to closed or semi-closed skills. While there is conflicting evidence in regard to the most effective structure of PPRs (Czech et al., 2004; Jackson, 2003; Wrisberg & Pein, 1992), they have been shown to be effective (Cotterill, 2011; Lonsdale & Tam, 2008; Thomas & Over, 1994).

From this understanding of PPRs, this study sought to fill several gaps in the literature. Specifically, this study extended previous research with a larger sample size, both genders of various ages and experience levels, as well as examining PPRs in competition rather than scrimmages or practices. The primary aim was to investigate how the use of a serve PPR, behavioral and temporal, interacts with serving accuracy in the sport of volleyball. The secondary aim further extended the collective knowledge of PPRs by looking at competitive anxiety (CA) and its relationship to PPRs. The tertiary

aim included exploration of gender differences. Additionally, this study answered calls for more competition-based observation of PPRs (Bell, Cox, & Finch, 2010).

Methods

Participants

Informed consent (Appendix A) was received from 40 participants (21 women and 19 men), from a possible total of 52 (21 women and 31 men). All participants were intercollegiate club volleyball players from a total of four teams (Women's A and B and Men's A and B). The participants' ages ranged from 18 to 22 (19.6 ± 1.2 years) and they were predominately Caucasian. Their years of experience playing volleyball ranged from less than one year to more than 12 years (mean category was "4-8 years"). Their perceived experience levels ranged from beginner to advanced, 65% described themselves as advanced.

Prior to beginning the study, the Primary Investigator (PI) determined that intercollegiate club players would be an ideal level of competition to focus on for two reasons. First, as demonstrated by Heishman (1989), routines are more useful after the basic skill has been learned and the technique is no longer the primary concern. Second, the access opportunities were greater than at the NCAA DI varsity level.

Measures

At the initial information meeting, consenting participants were asked to complete the Competitive State Anxiety Index- 2 (d) (CSAI-2(d); Appendix D) and a modified version of the CSAI-2(d) designed to look specifically at serving. A series of video recordings to obtain baseline measures of each participant's serve were also completed.

CSAI-2(d). The CSAI-2(d) measures the experience of both the intensity and direction, positive or negative, of cognitive anxiety, somatic anxiety, and self-confidence. This version was modified from the original CSAI-2 (Martens et al., 1990) in order to incorporate a directional subscale (Jones & Swain, 1992). The CSAI-2(d) has previously been used in sport psychology research (Jones & Uphill, 2004). The CSAI-2(d) was chosen over the CSAI-2 due to concerns about the trustworthiness of the data obtained from the CSAI-2 (Craft, Magyar, Becker, & Feltz, 2003; Lane, Sewell, Terry, Bartram, & Nesti, 1999; Lundqvist & Hassmen, 2005). The measure consists of 27 items, nine per subscale (i.e., cognitive anxiety, somatic anxiety, and self-confidence). Each item was rated on a 4-point Likert scale, resulting in scores ranging from 9 to 36 for each subscale. The three intensity subscales have adequate internal consistency with alphas between 0.79 and 0.90 (Martens et al., 1990). The directional scale for each item required participants to rate whether they perceived the intensity of their feelings to be facilitative (positive) or debilitating (negative) to their performance on a seven-point scale ranging from -3 (very debilitating) to +3 (very facilitative). Thus, possible direction scores ranged from -27 to +27 for each of the cognitive anxiety, somatic anxiety and self-confidence subscales. Internal consistency analyses for this scale have yielded coefficients between 0.80 and 0.89 for cognitive anxiety and 0.72 and 0.86 for somatic anxiety (Jones & Hanton, 2001). Through the CSAI-2(d), pertinent demographic information was also obtained (i.e. gender, ethnicity, age, experience level, and injury status).

The participants completed a second version of the CSAI-2(d) scale that was modified to be specific for volleyball serving. For example, the CSAI-2(d) item that stated, "I'm usually concerned about competing," was modified to, "I'm usually

concerned about serving.” This modified version was designed specifically for this study and the context of serving. In order to assess the validity of this modified version, a Pearson’s bivariate correlation was run between the scores of the CSAI-2(d) and the scores of the modified version for each of the subscales and their accompanying directional scores. Each of the CSAI-2(d) subscales were significantly correlated to their counterpart in the modified version (Cognitive: $r = .529$, $p = .001$; Somatic: $r = .528$, $p = .001$; Self-confidence: $r = .514$, $p = .001$). Findings were similar with the directional scores (Cognitive: $r = .546$, $p = .000$; Somatic: $r = .501$, $p = .001$; Self-confidence: $r = .488$, $p = .002$).

Video recordings. Video recordings were used to observe both the behavioral and temporal consistency of serve PPRs and serving accuracy among the participants. This is a commonly used strategy in research on PPRs (Cotterill, Sanders, & Collins, 2010; Czech, Ploszay, & Burke, 2004; Velentzas et al., 2010). After completing the CSAI-2(d) and the modified version specific to serving, video recordings were taken of each participant. Participants were asked to serve as they would in competition and to complete three total serves. The original purpose of these serves during practice were to provide a baseline measure of their serve PPR. For participants with more than one serve style (i.e., jump float, standing float, or jump topspin), three separate video recordings were taken of each serve style. Video recordings were also obtained at six different regional intercollegiate competitions so that each team was observed in at least two different tournaments. Observations were all taken in regional intercollegiate competitions to extend ecological validity (Lonsdale & Tam, 2008).

In the competition settings, each recording started when a participant was either heading back to serve or waiting behind the end line to receive the ball. As this was happening, the PI or research assistant behind the camera reported the current score into the camera's microphone. Then the serve was captured in its entirety through contact with the ball and finished with the PI or research assistant reporting the result of the serve (i.e., "make" or "miss") into the microphone. In conjunction with the video and audio recordings, a Serve PPR Recording Checklist (Appendix F) was also completed on paper. The checklist allowed the PI and the research assistant to keep an independent record of the score and each participant's serving percentage, which was used to ensure correct serving percentages. Serving accuracy was defined as either a "make" or a "miss" and was represented solely by a participant's serving percentage.

Procedure

The PI initially contacted the club presidents through email to determine their interest level and possible willingness to participate. Letters of consent to ask players for their participation were obtained from both the women's (Appendix B) and men's (Appendix C) club presidents prior to applying for IRB approval. This was done to ensure that the clubs were a viable participant pool. After the study was approved by the IRB, the PI met with potential participants at a team practice. At the practices, potential participants were provided with a brief introduction and specifics of what the study would involve. The teams were also informed of the study's interest in serving and serve PPRs. Players from both the women's and men's clubs were invited to participate in the study, regardless of position, playing time, or injury status.

Those who chose to participate signed an informed consent form and then completed both the CSAI-2(d) and the CSAI-2(d) modified. Participants were instructed to use their jersey numbers as their ID as approved by the IRB. Once the forms were complete, baseline video recordings were taken of each participant's serve. Before the recordings began, participants were instructed to "serve as they normally would during competition" to facilitate an accurate depiction of their serving process. Recordings continued until all of the serve styles from each participant were recorded at least three times.

From these initial recordings, a baseline description of the serve PPR was created for each participant (i.e. bounces the ball twice with both hands, spins in right hand, bounces again with a right-handed flat toss). The baseline serve PPR description included as much detail as possible, including which hand was used, the type of toss, and number of steps taken. This baseline was then used as a model from which to compare video recordings taken during competition.

Competition-based video recordings were taken at a total of six regional tournaments during the spring season which allowed for each of the four teams to be observed in two different tournaments. The video recordings were taken in as unobtrusive a manner as possible, with the PI or research assistants positioning themselves behind, and side of court to limit the noticeability of their presence. The video recordings were taken as described above, including both the visual and auditory pieces in addition to completing the Serve PPR Recording Checklist. All of the tournament locations had adequate space allowances for servers, such that possible variations in the participants' serve PPR was not due to spatial limitations.

All data were stored by Participant ID, which included CSAI-2 (d) and the modified CSAI-2 (d) scores, all recordings, both baseline and competition-based, completed copies of the checklist, and the data analysis results (i.e. serve PPR baseline, temporal baseline, serving percentage, and maintainer or non-maintainer status).

Data Analysis

In order to assess behavioral consistency, each participant was identified as either a maintainer (MTR) or a non-maintainer (NMTR), which was defined by how strictly the participant adhered to the behavioral aspects of their serve PPR. Those who maintained the actions of their serve PPR more than 90% of time were considered MTRs and those who maintained the actions of their serve PPR 0-30% of the time were considered NMTRs. These categories of maintenance mimic those used by Czech, Ploszay, and Burke (2004). To complete this coding, each video recording for each participant was viewed and categorized as either a maintenance or non-maintenance of their behavioral serve PPR, as compared to the baseline composite. Video recordings were excluded if the entire serve PPR was not visible. Consistent with the study by Czech et al. (2004), only those participants who had 10 or more total recorded serve attempts were included in the analysis. From a total of 942 film clips, 872 or 92.5% were eligible for analysis. Then, based on their total number of video clips, each participant's maintenance percentage was computed and the participant was coded as a MTR (90% or more), a NMTR (0-30%), or neither (31-89%). The serve percentage was then computed for each individual and averaged for the entire group to compare between group differences on serving accuracy.

In regard to the temporal consistency of serve PPRs, a separate analysis was completed on the timing of each individual participant's serve PPR. This was assessed by

timing each video recording from the beginning of the serve PPR through contact with the ball. Standards for individual video recording exclusions and minimum required total recorded serve attempts used in assessing behavioral consistency, detailed above, were also maintained here. Then, for each participant, all of their serve PPR times were averaged and the confidence interval became the boundaries for the acceptable “temporal consistency range.” This excluded outlying times that were more than one second different from the next closest time. This process mimicked that used by Jackson (2003) in a study that also assessed routine consistency.

Using the temporary consistency range, each individual serve was coded as maintenance if the time was within that range or as non-maintenance if it was outside that range. Then, based on their total number of video clips, each participant’s temporal consistency percentage was computed. The same grouping process used to assess the behavioral consistency was utilized for temporal consistency as well. Those who maintained their serve PPR timing 90% or more of the time were considered temporal maintainers (T-MTR) and those who maintained it 0-30% of the time were considered non-temporal maintainers (NT-MTR). The serve percentage was then computed for each individual and averaged for the entire group to compare between group differences on serving accuracy.

The behavioral and temporal consistency of the serve PPRs were analyzed separately due to the inconsistent findings between behavioral and temporal consistency. Independent t-tests were utilized to compare maintainers to non-maintainers (both behavioral and temporal) on serving accuracy. In order to assess observational reliability, an undergraduate research assistant also performed the coding process on a random

sample of 10% of the video recordings, similar to the process used by Jackson (2003) and Lonsdale and Tam (2008). The inter-rater reliability was 75.45%.

In analyzing the secondary aim, independent t-tests were conducted to compare maintainers to non-maintainers on both the CSAI-2(d) and the modified version of the CSAI-2(d). In regard to the tertiary aim of gender differences, the effect of gender on years of experience, experience level, and serving percentage were analyzed using independent t-tests. The effect of gender on maintenance, both behavioral and temporary, was also analyzed using independent t-tests. All statistical analyses were conducted in SPSS or StatKey.

Results

Fifty-two participants were asked to participate and 12 declined. Another 10 were excluded because they did not meet the minimum serve requirement and one additional participant was excluded due to injury. Therefore, the final analysis included 29 participants. Participant recruitment is summarized in Figure 1. Of the participants

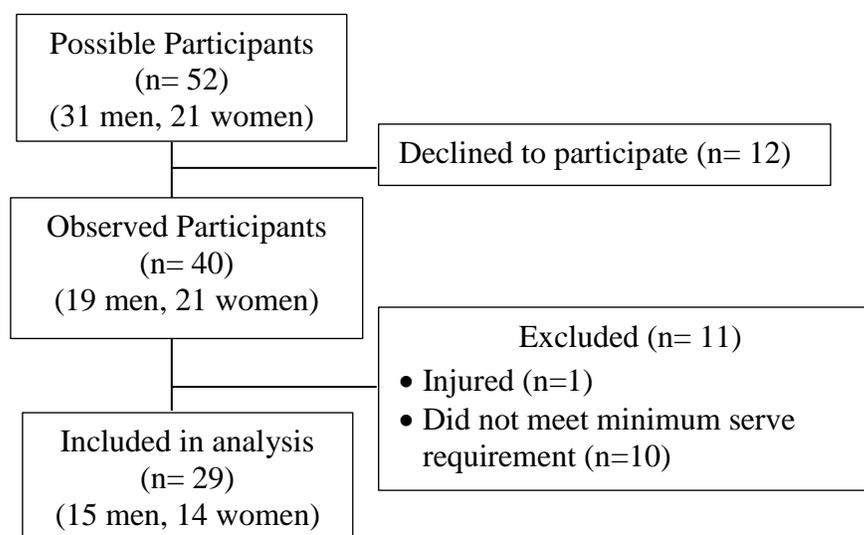


Figure 1. Flow of Participants through Study.

meeting the minimum recording requirements, there was an average of 29.8 eligible recordings (38.0 for women, 21.6 for men).

Primary Aim: PPRs and Serving Accuracy

Four participants met the requirements to be considered Maintainers (MTR; 90% or more of the time maintained the same behavioral serve). Furthermore, five participants met the requirements to be considered Non-maintainer (NMTR; maintained the same behavioral serve PPR 0-30% of the time). There was no difference between MTR and NMTR on serving accuracy ($t = 1.245$; $p = .250$). The average behavioral consistency for all participants was 57.87% and their serve percentage was 88.40%. A Pearson correlation between behavioral maintenance percentage and serving percentage showed no correlation between the two factors ($r = .001$, $p = .497$).

In regard to temporal consistency, none of the participants met the requirements of the Temporal Maintainer group (T-MTR; maintained a serve PPR time with the temporal consistency at 90% or more of the time). Furthermore, none of participants met the requirements for the Non-Temporal Maintainer group (NT-MTR; maintained a serve PPR time with the temporal consistency range of 0-30% of the time). The average temporal consistency for all participants was 66.56% and their serve percentage was again 88.40%. There was also no correlation between temporal consistency and serving percentage ($r = .279$, $p = .071$). Table 1 summarized the mean demographic data by serving percentages.

Table 1
Mean Demographic Data of Behavioral and Temporal Serve PPRs and Serve Percentages

Group	Number of Serves Made	Number of Serves Attempted	Serving Percentage	Number of Participants	Average Maintenance Percentage
Behavioral Maintenance					
Maintainers	195	213	90.53 %	4 (4 women, 0 men)	97.54%
Non-Maintainers	129	147	85.74%	5 (1 women, 4 men)	29.26%
Remaining Participants	506	580	89.36%	20 (9 women, 11 men)	55.78%
Temporal Maintenance					
Maintainers	-	-	0%	-	-
Non-Maintainers	-	-	0%	-	-
Remaining Participants	830	940	88.29%	29 (14 women, 15 men)	66.56%

Secondary Aim: Competition Anxiety

Mean results for scores on each of the CSAI-2(d)'s subscales, as well as those from the modified version are summarized in Table 2. There were no significant differences between the MTR and NMTR groups on the any of the subscales in either version, nor were there differences on the subscales between genders.

Table 2
Competitive Anxiety and Directional Sub-Scale Scores

Sub-Scales	Mean	Minimu m- Maximu m	Directional	
			Mean	Minimum- Maximum
CSAI-2(d)				
Cognitive Anxiety				
Women	20.39	9 – 31	.39	-12 - +27
Men	21.58	14 – 28	3.32	-11 - +19
Total	20.90	9 - 31	1.925	-12 - +27
Somatic Anxiety				
Women	17.27	9 - 25	4.62	-9 - +27
Men	19.08	11 - 28	4.42	-7 - +19
Total	18.05	9 - 28	7.739	-9 - +27
Self-Confidence				
Women	24.79	12 - 36	9.54	-10 - +27
Men	26.78	23 - 33	14.11	-3 - +21
Total	25.87	12 - 36	9.076	-10 - +27
CSAI-2(d) Modified				
Cognitive Anxiety				
Women	20.81	9 - 30	-0.61	-19 - +27
Men	20.73	13 - 28	-0.44	-19 - +20
Total	20.794	9 - 30	.307	-19 - +27
Somatic Anxiety				
Women	16.18	9 - 29	3.92	-18 - +27
Men	16.48	9 - 27	2.5	-18 - +23
Total	16.153	9 - 29	4.384	-18 - +27
Self-Confidence				
Women	25.22	16 - 36	9.38	-18 - +27
Men	26.09	16 - 36	12.8	-9 - +27
Total	25.692	16 - 36	11.205	-18 - +27

Tertiary Aim: Gender Differences

Women made 87.65% of their serve attempts and men made 89.11% of their serve attempts. There were no gender differences on any of the general or volleyball specific demographics (see Table 3).

Table 3
Mean Demographic Data by Gender

Gender	Age	Classification	Ethnicity	Years of Experience	Experience Level
Women					
<i>M</i>	19.76	Sophomore	90.47% Caucasian	8-12	Advanced
Men					
<i>M</i>	19.42	Freshman	84.21% Caucasian	4-8	Advanced

Four of the 14 women met the criteria for the MTR group, but none met the criteria for the NMTR. Conversely, while none of the men met the criteria for the MTR, four of the 15 men met the criteria for the NMTR. Overall, there were no significant differences between gender and serve PPR maintenance ($t = -1.398$; $p = .173$). Women did, however, maintain their behavioral serve PPR (72.05%) at a significantly higher percentage than the men (44.63%), $t = 3.54$, $p = .001$. For temporal serve PPR maintenance, as described above, none of the participants qualified for either the T-MTR or NT-MTR groups. Overall, women maintained their temporal serve PPR 68.11% of the time and men maintained theirs 66.23% of the time with no significant differences between groups ($t = .589$, $p = .561$).

Discussion

Behavioral and Temporal Maintenance

There was not a significant difference between the behavioral MTR and NMTR groups on serving accuracy, nor was there any correlation between maintenance

percentage and serving percentage. This finding did not support the hypothesis, but did confirm similar findings by Czech, Ploszay, and Burke (2004). In their study among collegiate basketball players, findings indicated that free throw shooting accuracy was not significantly related to PPR maintenance, though maintainers did have higher shooting percentages. These results contradicted the findings of Lonsdale and Tam (2008), which found that adherence to a dominant PPR was related to greater free throw accuracy among NBA players. It was also contrary to evidence found among golfers. For example, Thomas and Over (1994) found that routines were significantly correlated with golfers' handicaps. Additionally, Boutcher and Zinsser (1990) found differences in the pre-putt patterns of elite golfers versus those of beginners, such that their pre-putt routines were longer and more consistent behaviorally.

In regard to temporal consistency, there were no participants that met the criteria to be in either the T-MTR or the NT-MTR groups. The overall average temporary consistency was 66.56%, which did not correlate to serving percentage. While some evidence does suggest that temporal consistency is important for accuracy (Wrisberg & Pein, 1992), the current findings support the hypothesis that there would be no accuracy differences based on temporal consistency. This also added further support to the more prominent body of evidence that temporal consistency does not influence skill accuracy (Jackson, 2003; Lonsdale & Tam, 2008; Southard & Miracle, 1993).

These findings show that the relationship between the use of a PPR, whether behaviorally or temporally assessed, and accuracy in closed skills does not necessarily translate across sports. Findings in basketball have been contradictory (Czech, Ploszay, & Burke, 2004; Lonsdale & Tam, 2008), while findings in golf have primarily shown PPRs

to be effective (Boutcher & Zinsser, 1990; Thomas & Over, 1994). Results among wrestlers and divers (Highlen & Bennett, 1983), cricket (Cotterill, 2011), rugby (Jackson, 2003), tennis players (Moore, 1986), and gymnasts (Zaichkowsky, 1983) have demonstrated that routines that contain both cognitive and behavioral components are effective in improving performance.

Within the sport of volleyball; however, strict serve PPR maintenance may not be as important for successful performance. While there is a stoppage of play prior to the serve and it is in the sole control of the server, there are different environmental factors present that are not present in other sports. These factors include spectator movement, proximity to the variations in the referee's whistle speed, and changes in space allowances for serving. Servers in volleyball have a different environment to perform their closed-skill in, which can even change from serve to serve. It is also possible that the accuracy results associated with sports like golf are not present in volleyball serving because it has a much larger margin of error than putting in golf where strict PPR maintenance may be more important.

Future research. Future research on serve PPRs should examine the relationship of the rhythmicity of serve PPRs to serving accuracy. Rhythmicity refers to the ratio between concentration and physical preparation time (Jackson, 2003). The strict behavioral and temporal maintenance requirements of the present study may not have allowed for a more fluid type of PPR that better incorporates the different environmental factors specific to volleyball (i.e., removing one bounce when the referee has a faster whistle, or including several more spins if waiting for the completion of a substitution).

Furthermore, it may be more relevant for PPR research on volleyball to focus on PPR factors such as situational pressure (Krane, Joyce, & Ratfeld, 1994; Smith, Bellamy, Collins, & Newell, 2001) where the successful execution of a serve is perceived to be more crucial than at other points (i.e., when the score is close, right after a time out, the final point of a game). Given serving does have a large margin of error; the execution of a behavioral serve PPR may not be as influential as a mental serve PPR. Smith et al. (2001) found that club volleyball players rated their mental effort to be higher in closely contested games (score difference of 2 points or less) than in games that were moderately (3-6 points) or lowly (more than 6 points) contested. Those who maintain serve PPRs may have more particular success at such critical points if they have developed a PPR that includes both behavioral and cognitive components. Further research on serve PPRs should ask participants if they also incorporated a mental cue or a cognitive component in their serve PPR and compare that to their serving accuracy during critical points.

Competition Anxiety

The current findings from the CSAI-2(d) showed that all of the participants experienced a similar amount of cognitive (mean= 20.90) and somatic anxiety (mean=18.05) compared to scores (mean= 18.04 and mean= 17.26, respectively) from Martens, Vealey, and Burton (1990), who developed the original CSAI-2, which as without directional measures. On the subscale of self-confidence, participants scored similarly (mean= 25.875) to that of Martens et al. (mean= 25.02). Though not significantly different, the greater reported amount of cognitive anxiety compared to somatic anxiety could be due to the fact that the participants were all relatively advanced players with a number of years of experience. The skills required had been adequately

learned, which allowed for more mental capacity to be utilized beyond the execution of the skills themselves (Lidor & Singer, 2000; Weinberg & Gould, 2003).

Furthermore, in regard to direction, participants reported the experience of cognitive anxiety (mean= +1.925) and somatic anxiety (mean= +7.739) to be positive. On the self-confidence subscale, participants also reported their experiences to be in a positive direction (mean= +9.076). The positive interpretations of their experiences of cognitive and somatic anxiety are likely due to their years of experience and perceived experience level, which may also be influenced by their positive experience of self-confidence. However, Jones and Uphill (2004), who also used the CSAI-2(d), advise caution when interpreting the directional nature of the scores due to their finding that 37.1% of their participants incorrectly classified their scores.

Findings from the modified CSAI-2(d) showed similar results (cognitive mean= 20.794, somatic mean= 16.153, self-confidence mean= 25.692). The direction of these experiences was; however, slightly different than what was reported on the standard CSAI-2(d). While somatic anxiety (mean= 4.384) and self-confidence (mean= 11.205) were again experienced similarly, cognitive anxiety (mean= .307) was close to neutral. The less positive attribution of cognitive anxiety on the modified survey asking specifically about serving may point to the increased mental strain of the closed skill. A player must leave the court and be singled out to begin play while all eyes are on that particular player, which is not the case once the ball is in play. The very nature of the serve could create more cognitive pressure. This finding relates to a call from Jones and Uphill (2004) for more sport-specific inventories that better assess the range of emotions experienced by athletes in particular sports. An understanding of the possibility for

increased cognitive anxiety surrounding a serve, would give sport psychology professionals insight into building psychological tools specific to both factors.

In considering each of the subscales, the one that warrants the most attention for performance purposes is self-confidence. In their meta-analysis of the CSAI-2, Craft, Magyar, Becker, and Feltz (2003) explained that self-confidence seemed to be related to enhanced performance. It may be that higher experiences of self-confidence may also influence the way in which individuals perceive the directionality of both cognitive and somatic anxiety. Although they experience feelings of anxiety, the more dominant feeling of self-confidence may mitigate the anxiety and allow the participants to attribute it more positively. That is, the feelings are facilitative for performance in that they signal an, “I am ready” attribution. This is in opposition to a debilitating feeling signifying, “I’m scared” or “I’m nervous that I’m going to fail,” because the individual has a higher level of self-confidence. This relates to the findings of Jones and Hanton (2001) on pre-competitive feeling states and directional anxiety interpretations, as discussed previously. They found that participants with more positive attributions of anxiety considered the feelings to facilitate their performance. It may then also be that positive attributions of self-confidence influence the attributions of cognitive and somatic anxiety to concurrently be more positive.

Future research. More information is needed on the relationship between CA and PPRs. The current study’s sample size may not have had enough power to see between group differences. Larger, more diverse samples (i.e., different sports, experience levels) may demonstrate a relationship between CA and PPRs. Using modified versions of the CSAI-2 and CSAI-2(d) that ask specifically about the

appropriate closed skill is also important for further grooming knowledge about CA and PPRs. Additional research is needed to better understand how experiences of self-confidence may influence feelings and attributions of CA. A better understanding of how the use of a PPR could affect those who report low self-confidence or being debilitated by feelings of CA is also needed. Intervention studies assessing CA, with particular interest in self-confidence, before and after the introduction of PPRs, would be ideal.

Gender Differences

There were no general or volleyball specific demographic differences between the two genders, although women reported a greater number of years of experience, which is expected due to differences in access (NFHS, 2012). The findings indicated that consistent with the hypothesis, women were significantly higher maintainers of a behavioral serve PPR than their male counterparts, 72.05% and 44.63% respectively. However, this did not correlate to their serving percentage.

This finding could be due to the disparity of access between women and men with women having more access to rigorous training, coaching, and competing opportunities in volleyball (NFHS, 2012). As volleyball grows as a sport for men, this difference may lessen. The disparity could also be due to a combination of experience, perceived ability, and self-confidence. The women reported more years of experience (mean= 8 to 12 years) than the men (mean= 4 to 8 years), but reported a similar perceived ability level of “advanced” and scored similarly on the self-confidence subscales on the CSAI-2(d) (women= 24.79, men= 26.78) and the modified version (women= 25.22, men=26.09). Though the difference in scores between the women and men were not significant, they were consistent with the initial CSAI-2 findings by Martens, Vealey, and Burton (1990)

that women had slightly lower self-confidence scores. The inclusion of a serve PPR over their longer playing careers may help women feel more prepared and confident in completing the skill. While men, who have fewer years of experience, may rely more on their self-confidence in their athletic abilities to complete the skill and routines may not be viewed as crucial. More on the issue of self-confidence and PPRs is discussed below.

Future research. Moving forward, research on gender differences should include qualitative research to better understand the differences in training techniques used by coaches and how they influence whether women or men implement a PPR. The issue of access may also mean that the coaching styles used with one gender do not necessarily work best with the other gender. Examining coaching is important because as noted by McCann (2008), one of the crucial aspects of coaching is instilling fundamental routines in their athletes. Another area where further research is needed is in examining the influence of self-confidence in the use of behavioral serve PPRs. The difference in self-reported self-confidence, though small, could be influential in how women use serve PPRs differently than men. Qualitative research, specifically focus groups or semi-structured interviews, would shed more light on the reasons for such differences.

Limitations

There are several limitations in the current study. First, unlike previous studies, the purpose of the study was disclosed to the participants. Previous PPR studies have not disclosed the purpose of the study (Czech, Ploszay, & Burke, 2004) and therefore, participants were unaware of what the researchers were examining. However, the current study disclosed to participants that their serves were being observed. This was done because the competition settings were intimate small gyms and the participants would

have been aware of the recordings and checklist. Second, the initial video recordings of the participants' serving at practice, which were taken to formulate baseline measures for their behavioral serve PPR, were taken in an environment that did not closely mimic a competition setting. Although participants were asked to "serve as you normally would in competition," the three serve samples were taken in quick succession, which would never happen in a competition setting. A more accurate measure would have been to film participants during a scrimmage in practice, which would better simulate competition. Third, the current study did not assess any potential cognitive components of the participants' serve PPR. Both the behavioral and cognitive components of a PPR are considered to be important in creating an effective routine. A more comprehensive assessment of serve PPRs would have included asking participants if they also incorporated a mental cue or some cognitive component in their serve PPR. Fourth, the inter-rater reliability was low. Similar studies have reported no differences in inter-rater reliability rates (Czech, Ploszay, & Burke, 2004) or significant correlations between the two ($p < .0001$; Jackson, 2003).

Furthermore, the definition of accuracy in the current study was limited only to whether the serve was a "make" or a "miss." In the measurement of some closed-skills, like free throws in basketball or field goals in football, this is sufficient. However, in volleyball serves, there is a wide range of accuracy. A miss can include: (1) a serve that does not go over the net; (2) a serve that crosses the net, but lands out of bounds; or (3) a serve that was itself legal, but was done in conjunction with something else illegal (e.g., out of rotation). While a make can include: (1) an easy or "lollipop" serve, (2) a consciously directed serve aimed at weaker passers, or (3) an ace, which directly results

in a point. Future research should more meticulously assess accuracy to incorporate this wide range. Finally, the current study only offers correlational data on the relationships between behavioral and temporal serve PPR maintenance and serving accuracy. Future research should involve interventions to better assess these relationships.

Summary and Conclusions

This study shows that neither the use of a strict behavioral serve PPR, nor a temporally consistent one were associated with greater serving accuracy in volleyball. In regard to behavioral maintenance, this finding adds to the conflicting body of knowledge as to the performance benefits of a PPR. Furthermore, the current findings offer initial evidence on the relationship between CA and PPRs. Though the current results were not significant, more exploration is warranted. Finally, gender differences have seldom been considered in research on PPRs, but extending research in this area will better equip sport psychology professionals in applied settings working with single-sex or co-ed teams.

The current study indicates that more research is needed on a wider swath of sports and closed-skills. This research will allow sport psychology professionals to give athletes the best possible mental training tools, ones that match all of the relevant contextual considerations. Prescriptions for the use of PPRs do not necessarily translate from sport to sport. Different sports have different contexts (e.g., rules, space allowances, time) in which closed skills must be performed. A strictly maintained PPR in a golf putt may have similar effectiveness to the gradual temporal increase of a football punt PPR depending on the difficulty or maintaining the rhythmicity of serve PPR. Practical recommendations from the present study are thus to consider a variety of contextual cues

(e.g., sport, nature of the closed-skills, perceived self-confidence) before utilizing PPRs strictly for performance enhancement.

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Appendix A

CONSENT FORM

Pre-performance Routines in Club Volleyball Players

You are invited to be in a research study of pre-performance routines. You were selected as a possible participant because of your affiliation with the men's or women's club volleyball team. I ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by: Lauren Billing, MS student, School of Kinesiology

Background Information

The purpose of this study is to look at pre-performance routines (PPR). According to Boutcher and Crews (1987) a PPR allows athletes to focus exclusively on a series of well-rehearsed cues just before completing a learned skill, which will help to reduce the likelihood of focusing on potentially detrimental thoughts, like what the outcome will be, the immensity of the moment, negative feelings or thoughts, or the physical requirements of performing the skill.

Pre-performance routines (PPR) have been shown in a variety of sports to enhance athletes' abilities to concentrate on the skill at hand, control arousal levels and feelings of anxiety, and use it as a cue to improve performance. Current research on PPRs has looked at a small variety of sports, most notably basketball and golf, in the context of closed skill execution. Much of what is known about PPRs has looked at these two sports, but largely in a practice or scrimmage situation where the pressures of competition are present at a much lower level. The current study seeks to expand what is known about PPRs by looking at the closed skill of serving in the sport of volleyball and to do so within competition.

Procedures:

If you agree to be in this study, I would ask you to do the following things: sign the present consent form and fill out a questionnaire, which includes demographic questions (i.e. gender, age), sport specific questions (i.e. number of years playing volleyball, highest level of competition and positions played), and questions about anxiety during competition. The final piece is being willing to be video taped once during a practice and then for the duration of one regional tournament.

Confidentiality:

The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify a participant. Research records will be stored securely and only researchers will have access to the records. Study

data, including video tapes of serves, will be encrypted according to current University policy for protection of confidentiality.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota or the men's or women's club volleyball team. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

Risks and Benefits of being in the Study

The risks involved in this study are minimal. The only anticipated risk is the possibility of decreased serving performance due to any anxiety over being video recorded. In order to minimize these effects, the camera will be placed in an unobtrusive position as possible during competition recording.

There are limited benefits to participation as there is no treatment or information provided to you as a participant. However, the results of the study will be available to you, as well as your individual serving percentages over the data collection period if you would like access to it. This can be obtained by request to Lauren Billing.

Contacts and Questions:

The researcher conducting this study is: Lauren Billing. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact me in Cooke Hall, (719) 432-9485, billi183@umn.edu. You can also contact my advisor Dr. Beth Lewis at (612) 625-0756 or blewis@umn.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact the Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, Minnesota 55455; (612) 625-1650.

A copy of this information is available to keep for your records.

Statement of Consent:

I have read the above information. I have asked questions if I had them and have received answers. I consent to participate in the study.

Signature: _____ Date: _____

Signature of parent or guardian: _____ Date: _____
(If minors are involved)

Signature of Investigator: _____ Date: _____

Appendix B



University of Minnesota Women's Club Volleyball

12/2/2013

Lauren Billing
3217 Dupont Ave. S., Unit 2
Minneapolis, MN 55408

Dear Lauren Billing,

We have reviewed your research proposal and supplemental information. We grant permission for you to recruit players of the women's club volleyball team for the purpose of your research, pre-performance routines in club volleyball players.

Sincerely,

Coral Evans
President- U of M Women's Club Volleyball

A handwritten signature in black ink, appearing to read 'Coral Evans', written in a cursive style.

Anjelica Bailey
Vice President- U of M Women's Club Volleyball

A handwritten signature in black ink, appearing to read 'Anjelica Bailey', written in a cursive style.

Appendix C

**University of Minnesota Men's Club Volleyball**

12/2/2013

Lauren Billing
3217 Dupont Ave. S., Unit 2
Minneapolis, MN 55408

Dear Lauren Billing,

We have reviewed your research proposal and supplemental information. We grant permission for you to recruit players of the men's club volleyball team for the purpose of your research, pre-performance routines in club volleyball players.

Sincerely,

A handwritten signature in black ink that reads "Graham Bringman".

Graham Bringman
President- U of M Men's Club Volleyball

Appendix D

Pre-performance Routine Questionnaire

Dear Club Volleyball Athlete,

Thank you for participating in this study. Please be assured that all information you provide will be kept completely confidential, and results of this data collection will only be reported as group information. Although I will need an ID # to keep your data together, your individual answers will not be made available to anyone. Over-all results will be made available to you, other athletes involved in the study, and the coaches, if so desired.

Pre-performance ID # (Jersey #) _____

1. Gender

- Male Female

2. Ethnicity

- African-American Asian Caucasian Hispanic
 Native American Other _____

3. Age. Please write in your age if you are under 18 or over 24 _____

- 18 19 20 21 22 23 24

4. Classification

- Freshman Sophomore Junior Senior

5. Years of volleyball Experience

- ≤ 1 year 2-4 years 4-8 years 8-12 years 12+ years

6. Highest level of volleyball Experience

- ≤ 1 year 2-4 years 4-8 years 8-12 years 12+ years

7. Are you currently not playing due to injury, academic reasons, etc?

- Yes, I am currently **not** playing No, I am currently playing

Athletic Competition Self-Evaluation Questionnaire

Directions:

A number of general statements that athletes have used to describe their feelings before competition are given on the first questionnaire you are about to fill out. Read each statement and circle the appropriate number to the immediate right of the statement to indicate *how you feel right before* competing (intensity scale). Then, when you have this feeling, do you normally regard it as being negative or positive in relation to competing (directional scale). That is, do you feel like the symptom will help (positive), hurt (negative), or have no effect on your performance (unimportant). Always answer both sides of the scales for each question before moving to the next item. Do not spend too much time on any one statement, but choose the answers which best describes your feelings *in general* before a competition.

	INTENSITY SCALE				DIRECTIONAL SCALE						
	Not At All		Very Much		Very Negative-Unimportant-Very Positive						
1. I'm usually concerned about competing	1	2	3	4	-3	-2	-1	0	+1	+2	+3
2. I feel nervous before I compete	1	2	3	4	-3	-2	-1	0	+1	+2	+3
3. I feel at ease before competing	1	2	3	4	-3	-2	-1	0	+1	+2	+3
4. I have self-doubts before I compete	1	2	3	4	-3	-2	-1	0	+1	+2	+3
5. Usually I feel jittery before competing	1	2	3	4	-3	-2	-1	0	+1	+2	+3
6. I usually feel comfortable before competing	1	2	3	4	-3	-2	-1	0	+1	+2	+3
7. I am concerned that I may not do as well as I could when competing	1	2	3	4	-3	-2	-1	0	+1	+2	+3
8. My body feels tense before competing	1	2	3	4	-3	-2	-1	0	+1	+2	+3
9. I usually feel self-confident before competing	1	2	3	4	-3	-2	-1	0	+1	+2	+3
10. In general, I am concerned about losing	1	2	3	4	-3	-2	-1	0	+1	+2	+3
11. I feel tense in my stomach before a competition	1	2	3	4	-3	-2	-1	0	+1	+2	+3
12. I feel secure before I compete	1	2	3	4	-3	-2	-1	0	+1	+2	+3
13. I get concerned about choking under pressure	1	2	3	4	-3	-2	-1	0	+1	+2	+3
14. My body usually feels relaxed	1	2	3	4	-3	-2	-1	0	+1	+2	+3
15. I'm usually confident I can meet the challenge	1	2	3	4	-3	-2	-1	0	+1	+2	+3
16. Usually I'm concerned about performing poorly	1	2	3	4	-3	-2	-1	0	+1	+2	+3
17. My heart is usually racing before I compete	1	2	3	4	-3	-2	-1	0	+1	+2	+3
18. I'm usually confident about performing well	1	2	3	4	-3	-2	-1	0	+1	+2	+3
19. I'm usually concerned about reaching my goal	1	2	3	4	-3	-2	-1	0	+1	+2	+3
20. I get a sinking feeling in my stomach	1	2	3	4	-3	-2	-1	0	+1	+2	+3
21. I usually feel mentally relaxed	1	2	3	4	-3	-2	-1	0	+1	+2	+3
22. I am concerned that others will be disappointed with my performance	1	2	3	4	-3	-2	-1	0	+1	+2	+3
23. My hands get clammy before I compete	1	2	3	4	-3	-2	-1	0	+1	+2	+3
24. In general, I'm confident because I mentally picture myself reaching my goal	1	2	3	4	-3	-2	-1	0	+1	+2	+3
25. I'm concerned I won't be able to concentrate	1	2	3	4	-3	-2	-1	0	+1	+2	+3

26. My body usually feels tight before competing	1	2	3	4	-3	-2	-1	0	+1	+2	+3
27. I'm confident of coming through under pressure	1	2	3	4	-3	-2	-1	0	+1	+2	+3

Appendix E

Athletic Competition Self-Evaluation Questionnaire- Modified

The statements below are similar to the questions you answered above, but they have been modified for the purposes of this study to.

Directions:

Read each statement and circle the appropriate number to the immediate right of the statement to indicate *how you feel right before* serving in competition (intensity scale). Then, when you have this feeling, do you normally regard it as being negative or positive in relation to serving in competition (directional scale). That is, do you feel like the symptom will help (positive), hurt (negative), or have no effect on your performance (unimportant). Always answer both sides of the scales for each question before moving to the next item. Do not spend too much time on any one statement, but in considering each statement choose the answers which best describes your feelings *associated specifically with serving* during a competition.

	<u>INTENSITY SCALE</u>				<u>DIRECTIONAL SCALE</u>								
	Not At All	1	2	3	4	Very Negative	-3	-2	-1	0	+1	+2	+3
<u>Positive</u>													
1. I'm usually concerned about serving	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
2. I feel nervous before I serve	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
3. I feel at ease before serving	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
4. I have self-doubts before I serve	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
5. Usually I feel jittery before serving	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
6. I usually feel comfortable before serving	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
7. I am concerned that I may not do as well as I could when serving	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
8. My body feels tense before serving	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
9. I usually feel self-confident before serving	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
10. In general, I am concerned about missing a serve	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
11. I feel tense in my stomach before a serve	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
12. I feel secure before I serve	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
13. I get concerned about choking under pressure	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
14. My body usually feels relaxed when I serve	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
15. I'm usually confident I can meet the serving challenge	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
16. Usually I'm concerned about serving poorly	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
17. My heart is usually racing before I serve	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
18. I'm usually confident about serving well	1	2	3	4	-3	-2	-1	0	+1	+2	+3		
19. I'm usually concerned about reaching my serving goal	1	2	3	4	-3	-2	-1	0	+1	+2	+3		

	<u>INTENSITY SCALE</u>				<u>DIRECTIONAL SCALE</u>							
	<u>Not At All</u>			<u>Very Much</u>	<u>Very Negative</u>			<u>Unimportant</u>	<u>Very</u>			
<u>Positive</u>												
20. <i>I get a sinking feeling in my stomach when I serve</i>	1	2	3	4	-3	-2	-1	0	+1	+2	+3	
21. <i>I usually feel mentally relaxed</i>	1	2	3	4	-3	-2	-1	0	+1	+2	+3	
22. <i>I am concerned that others will be disappointed with my serving performance</i>	1	2	3	4	-3	-2	-1	0	+1	+2	+3	
23. <i>My hands get clammy before I serve</i>	1	2	3	4	-3	-2	-1	0	+1	+2	+3	
24. <i>In general, I'm confident because I mentally picture myself reaching my serving goal</i>	1	2	3	4	-3	-2	-1	0	+1	+2	+3	
25. <i>I am concerned that I won't be able to concentration when serving</i>	1	2	3	4	-3	-2	-1	0	+1	+2	+3	
26. <i>My body usually feels tight before serving</i>	1	2	3	4	-3	-2	-1	0	+1	+2	+3	
27. <i>I'm confident of serving well under pressure</i>	1	2	3	4	-3	-2	-1	0	+1	+2	+3	

Thank you for your participation in this study.

Again, be assured that all information you provide will be kept completely confidential.

Contacts and Questions:

The researcher conducting this study is: Lauren Billing. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact me in Cooke Hall, (719) 432-9485, billi183@umn.edu. You can also contact my advisor Dr. Beth Lewis at (612) 625-0756 or blewis@umn.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact the Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, Minnesota 55455; (612) 625-1650.

