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# ATTENTIONAL FOCUS DOES NOT IMPACT AGILITY PERFORMANCE AMONGST DIVISION I WOMEN COLLEGIATE TENNIS PLAYERS

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ATTENTIONAL FOCUS DOES NOT IMPACT AGILITY PERFORMANCE AMONGST  
DIVISION I WOMEN COLLEGIATE TENNIS PLAYERS

By

Brett Bartholomew

Bachelor of Science, Kansas State University, 2008

A Research Paper

Submitted in Partial Fulfillment of the Requirements for the  
Masters of Science in Education Degree

Department of Kinesiology

Graduate School

Southern Illinois University- Carbondale

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RESEARCH PAPER APPROVAL

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of Masters of Science in Education

in the field of Kinesiology

Approved by:

Dr. Jared Porter, Chair

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AN ABSTRACT OF THE RESEARCH PAPER OF

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TITLE: ATTENTIONAL FOCUS DOES NOT IMPACT AGILITY PERFORMANCE AMONGST DIVISION I WOMEN COLLEGIATE TENNIS PLAYERS

MAJOR PROFESSOR: Jared M. Porter Ph.D.

The main objective of the current study was to examine the effects attentional focus had on agility performance with a population of highly trained tennis players performing the “T”-test. It was hypothesized that agility performance would be enhanced in this expert population through the means of adopting an external focus of attention rather than either an internal focus, or no specific focus of attention. Participants in the study ( $N = 8$ ) completed nine total trials (i.e., 3 under each condition), following instructions that were devised to elicit an external (EXT) focus, internal (INT) focus, or no focus (CON). Each of the conditions were counterbalanced throughout the three days of testing controlling for possible order effects. The analysis revealed that the results did not support the experimental hypothesis that agility performance would be enhanced after giving instructions designed to elicit an external (EXT) focus of attention. The results showed no statistically significant differences between the three conditions (INT, EXT & CON). These results suggest that elite athletes performing a complex, whole-body task such as the “T”-test will perform the task equally well regardless of how they focus their attention.

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## Introduction

Successful athletic performance in training or in sport depends heavily on interpersonal communication, skill level and the relationships between the athlete and the coach. It is through these interactions that coaches and athletes are able to build rapport with one another and learn what exercises, drills, verbal cues, or imagery techniques work best in order to achieve optimal performance and skill acquisition in competitive venues. Recent research in the field of motor behavior has demonstrated the impact that certain verbal cues in particular can have on improving an individual's attentional focus, the quality of their movements, as well as their desired outcomes (Wulf & Prince, 2001). It is through the use of verbal instructions that coaches are able to deliver valuable information to athletes that allow them to better understand the goals to be accomplished, as well as the most efficient way for the athletes to go about achieving success. It has long been recognized that being too concerned with, or even simply paying closer attention to one's movements can disrupt the performance of well-practiced skills (Bliss, 1892,1893; Boder, 1935). This research has made it increasingly clear that the production of fast, forceful, and purposeful movements is largely the outcome of our neuromuscular system, which is modifiable through learning, proper training, attention and intention (Bernardi, Solomonow, Nguyen, Smith & Baratta, 1996; Delecluse, Van Lemputte, Willems, Andries, Diels, & Van Coppenolle, 1995; Enoka, 1997; Ives & Shelley, 2003; Rutherford & Jones, 1986).

The concept and implementation of attentional focus research through verbal cueing has shown promise in a variety of outcome based performance tasks such as basketball shooting (Al-Abood, Bennerr, Hernandez, Ashford, & Davids, 2002; Zachry, Wulf, Mercer, & Bezodis, 2005), volleyball serves and passes in soccer (Wulf, McConneel, Gartner, & Schwarz, 2002), as well as in complex agility tasks such as the "L" drill (Porter, Nolan, Ostrowski, & Wulf, 2010). These findings suggest that simply modifying instructions through the use of externally focusing

verbal cues (i.e., direct one's attention toward a movement outcome, or effect on an implement/environment), rather than instructions that induce an internal focus (i.e., directs attention to the movement itself) is superior and may aid in the athlete's ability to learn how to perform both simple and complex skills more efficiently thus enhancing motor performance. The notion that motor performance is enhanced through the adoption of an external focus of attention is further reinforced through research by Wulf and colleagues (Wulf et al., 1998, 2000), and Porter, Ostrowski, et al. (2010), which demonstrated the powerful influence that focus of attention has on learning in general as well as the performance of motor skills. These authors have shown that adopting an internal focus (i.e., focusing on one's own body movements or limb position) results in both poorer learning and motor performance when compared to focusing on external cues (e.g., movement outcome, effect, or trajectory).

A practical example of these varying types of foci could be seen when instructing an athlete to perform a plyometric jump onto a box or over a hurdle. Instead of instructing the athlete to "achieve full extension of the ankle, knee and hip," when they jump, the coach could simply cue them by telling them to focus on "pushing the ground away from them." In the preceding example, telling the athlete to extend their ankle, knee and hip would elicit an internal focus, while the latter would be an example of an external focus. While both cues are aimed at getting the athlete to perform the same task, the external focus condition allows the athlete to simplify the task by allowing the motor control system to recruit muscle fibers more efficiently which may result in a more highly organized motor program (Porter, Nolan, et al., 2010). This is an important benefit since the primary purpose of motor-performance research is to modify movement skills with efficient learning techniques so that the movements themselves are well learned and motor behaviors become automated.

The constrained action hypothesis is often presented as the primary explanation as to why adopting an external focus of attention may impact performance in a more positive manner than adopting an internal focus. This view suggests that the conscious control of one's movement (i.e., internal focus) constrains the motor system by interfering with automatic motor control processes that would normally regulate the movement. In contrast, focusing on the movement effect (i.e., external focus), allows the motor system to more naturally self-organize through decreased interference from conscious control (Wulf, McNevin, & Shea, 2001). Research has shown that even if a performer is given no specific attentional focus instructions in regards to carrying out a specific movement (e.g., control condition), that they will still control their actions in a relatively conscious manner through internalizing the specifics of the movement itself, which may lead to a decrease in motor performance thus elucidating decreased shot accuracy, slower reaction time, and slower movements in general (Wulf, 2007). Further support for this hypothesis is demonstrated by the analyses of movement frequency characteristics (e.g., mean power frequency; MPF) in balance tasks, in which performers showed a higher rate of adjustments while adopting an external focus of attention compared to an internal focus (McNevin, Shea, & Wulf, 2003; Wulf, McNevin et al., 2001; Wulf, Shea, & Park, 2001). These high frequency adjustments indicate a more automatic, reflexive and more finely tuned movement response system allowing for improved stability and control (Thompson & Stewart, 1986).

The basic concept that consciously thinking about self-movement depresses motor performance was one of the primary reasons that Singer, Lidor and Cauraugh (1993) advocated that learner's adopt a "nonawareness strategy," which was later modified to be the 5-step approach. Singer et al. (1993), believed this strategy gave learners the best opportunity to

achieve skilled motor performance. The term nonawareness itself refers to a situation where reduced attention is placed on the activity while it is in progress, but where the learner is instructed to preplan the movement and focus on specific situational cues (Ives & Shelley, 2003). In other words, these nonawareness strategies are centered on mastering a specific movement outcome such as the trajectory of a ball or implement rather than focusing on the specifics of the movement itself as it pertains to body/limb alignment or position. Since movement itself is natural and instinctive, directing the athletes' attention to their environment may allow for a more optimal expression of motor-skill enhancement (Wulf, McNevin & Shea, 2001).

Despite the growing body of research demonstrating the positive effects of adopting an external focus on the performance of singular tasks (e.g., Al-Abood et al., 2002; Wulf et al., 2002); helping people diagnosed with Parkinson's disease (Landers, Wulf, Wallmann, & Guadagnoli, 2005) and even helping stroke victims (Fasoli, Trombly, Tickle-Degnen, & Verfaellie, 2002), there has been limited research on how attentional focus may impact the performance of whole-body agility based tasks, specifically in skilled populations. The majority of studies examining attentional focus effects have used novices as participants, while only a few have examined the effectiveness of different attentional foci in expert performers (Perkins-Cecatto, Passmore, & Lee, 2003; Wulf, 2008; Wulf, McConnel, Gartner, & Schwarz, 2002, Wulf & Su, 2007). It has been suggested that highly skilled performers interpret information from the environment more efficiently than non-experts and have more elaborate domain-specific knowledge such as knowledge of tactics and strategies (Ives & Shelley, 2003). If this is true, one might expect to see expert performers' skill level enhanced even more under external focus conditions. This hypothesis is supported by research conducted by Perkins-Ceccato et al. (2003), and Wulf and Su (2007), which displayed that the shot accuracy of skilled golfers benefited from

the adoption of external focusing instructions. However, there may be a limit to the performance-enhancing effects of adopting an external focus of attention amongst skilled performers. For example, Wulf (2008) demonstrated no major difference in postural sway in world-class acrobats balancing on an inflated disk amongst all focus of attention conditions. The conditions used by Wulf (2008) included each participant performing four 15s trials in which they were either instructed to “stand still” (control), “focus on minimizing movements of the feet” (internal), and “focus on minimizing the movement of the disc” (external). Wulf did note, however, that the frequency of movement adjustments was higher in the control condition as compared to both the internal and external focus conditions; which suggests that movement automaticity and overall stability were greatest when the performers were able to adopt their “normal” focus of attention.

Skilled performers may possess an increased ability to interpret information from the environment, and they presumably have an increased level of decision making ability that allows them to better anticipate and predict outcomes on the basis of the situational information that they are presented with (Abernathy, 1996; Abernathy, 1997; French & McPherson, 1999; Helsen & Starkes, 1999; McPherson, 1999; Thomas, 1994). If the performance of skilled performers is already near peak levels and is controlled with a high-degree of automaticity, one might not expect that the adoption of an external focus of attention would have any significant positive impact on motor performance, as demonstrated by Wulf (2008). This is a primary reason that the present study utilized highly skilled collegiate athletes that compete in the sport of tennis as participants. Tennis is a sport characterized by a high agility component as the athlete will utilize multiple movement techniques such as sprinting at different angles, cutting, shuffling, backpedaling, and cross-over and drop-step mechanics in order to defend their side of the court. Competing at the Division I level of tennis also implies that the athletes used in the present study

possess a high-level of mastery in these multi-directional movement techniques, which allow them to be more successful in agility based tasks and performances, compared to a non-expert performer.

Agility is defined as the ability to change the direction of the body rapidly using a combination of strength, speed, balance, and coordination (Sayers, Sayers, & Binkley, 2008). The “T”-test is an agility test used to measure multiplanar movement skills, and body control. More specifically, it measures the ability of the athlete to change directions rapidly while maintaining balance without loss of speed (Seminick, 1990). This test is specific to the movement demands of the game of tennis, which includes periods of rapid sprinting, shuffling, as well as backpedaling in order to cover all areas of the court. The primary purpose of this study was to more closely examine whether or not the use of an external focus enhances agility performance amongst skilled, female Division I collegiate tennis players performing the “T”-test. Due to findings in past research, it was hypothesized that participants completing the agility task would have a faster movement time when following instructions designed to induce an external rather than internal focus, or no focus of attention. This hypothesis is supported by past research that has demonstrated that when participants do not receive attentional focus instructions, such as those seen in the control condition, their performance is often times similar to what is seen under internal focus conditions (Landers et al., 2005; Wulf, HoB, & Prinz, 1998, Experiment 1; Wulf & McNevin, 2003; Wulf, Weigelt, Poulter, & McNevin, 2003). The present study is unique from the standpoint that it examined the effects that verbal instructions designed to elicit different kinds of attentional foci had on the performance of elite Division I collegiate athletes who were skilled at agility based tasks.

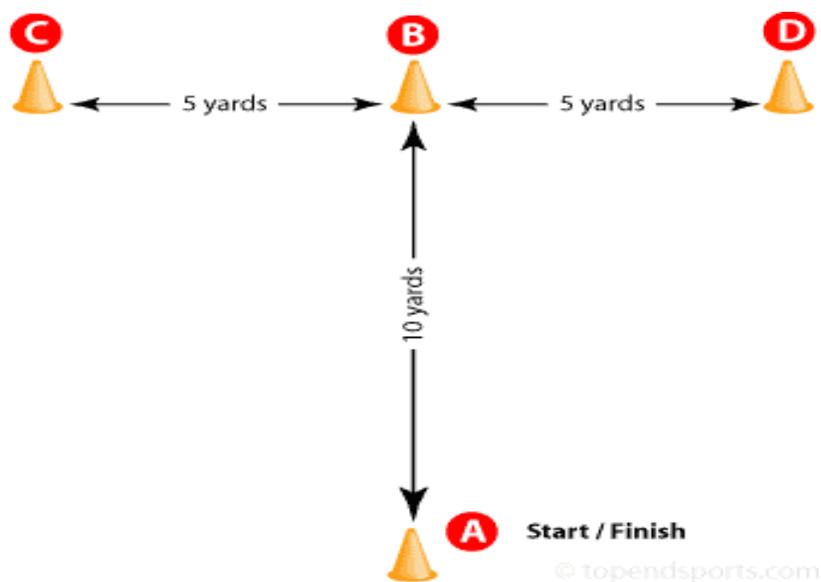
## Method

### Participants

Collegiate female tennis players ( $N = 8$ ) who were active members of a Division I varsity women's tennis team volunteered to participate in this study. The participants had an average age of 19.25 years ( $SD = 1.28$  years) and all signed an informed consent and completed a medical history questionnaire before participating in the study. All forms and experimental methods were approved by the University's Human Subjects Committee.

### Apparatus and Task

This study utilized the agility "T"-test to measure agility performance. The "T"-test is described as a measure of multi-directional agility and body control that evaluates the ability to change directions rapidly while maintaining balance without the loss of speed (Seminick, 1990). This test consisted of a total of four cones that were spaced apart in order to form a "T" on the training surface. The starting cone (i.e., cone 1) which served as the base of the "T" was spaced 9.14 meters from cone 2. Cones 2, 3 and 4 formed the top of the "T" and were spaced 4.57 meters apart from one another. A schematic representation of the "T"-test is provided below (see Figure 1).



*Figure 1.* Participant started at A, then sprinted to B before shuffling to cone C and D respectively. Once the participant shuffled from cone D back to cone B, they then backpedaled through cone A to complete the task.

The agility drill was conducted in an enclosed air-conditioned environment on a hard black rubber composite surface. The surface was similar to flooring surfaces commonly found in professional strength and conditioning training facilities.

For the purposes of data collection and analysis, electronic infrared timing gates (Brower Timing System, model IRD-T175) were placed on tripods facing each other at the starting/finish line (i.e., Cone A). The start and the finish line occurred at the same location, and was clearly marked through the use of brightly colored tape on the floor.

After the participant received the prescribed verbal instructions, she lined up behind the start line by Cone A, and waited for the test administrator to blow the whistle, which served to initiate the start of the task. Once the whistle was blown, the participant sprinted to Cone B

before shuffling left to cone C and then shuffling right to cone D. Once the participant shuffled from cone D back to cone B, she then backpedaled through cone A and passed through the timing gates to complete the task. Once the participant passed through the timing gate, data was transmitted to a wireless handheld device showing the time of completion of the respective task. Performance times were recorded to a computer spreadsheet and stored for later analysis.

## **Procedures**

Prior to the test, each participant took part in a 5-minute total-body dynamic warm-up, which was led by a Certified Strength and Conditioning Specialist. The movements performed during the dynamic warm-up progressed from a slower tempo to a faster tempo; beginning with dynamic stretches for the quadriceps, hip-flexors, hamstrings, and adductors, and finished with higher frequency movements such as cariocas, shuffle to sprints at approximately 75% effort, and lower intensity backpedaling. A distance of 18.28 meters (9.14 meters when moving both right and left respectively) was covered during each of the higher frequency warm-up activities.

A within-participant design was utilized for the duration of the agility testing, meaning each participant completed three trials under each condition. The conditions were counterbalanced throughout the three days of testing. Moreover, a different focus of attention was elicited on each day of testing. Prior to performance testing on day one, participants were provided a visual demonstration of the agility T-test. The participants were then allowed to perform two submaximal trial runs in order to familiarize themselves with the task. Once participants were familiar with the task, they were given one of the following verbal instructions, each of which represented one of three conditions (i.e., internal, external, or control).

*External:* “Once the whistle is blown, go full-speed throughout the entire drill. When shuffling, I want you to focus on aggressively pushing the ground away from you.”

*Internal:* Once the whistle is blown, go full-speed throughout the entire drill. When shuffling, I want you to focus on achieving aggressive full extension of the outside leg.”

*Control:* Once the whistle is blown, go full-speed throughout the entire drill.

## Results

Data were analyzed via the use of a one-way analysis of variance (ANOVA) with repeated measures. The results of this analysis indicated there were no significant differences between the experimental conditions,  $F(1, 23) = 0.285, p = 0.598$ . The average run times for each condition were: Control ( $M = 11.38$  s,  $SD = 0.57$ ), Internal ( $M = 11.27$  s,  $SD = 0.67$ ), and External ( $M = 11.29$  s,  $SD = 0.6$ ) (see Figure 2).

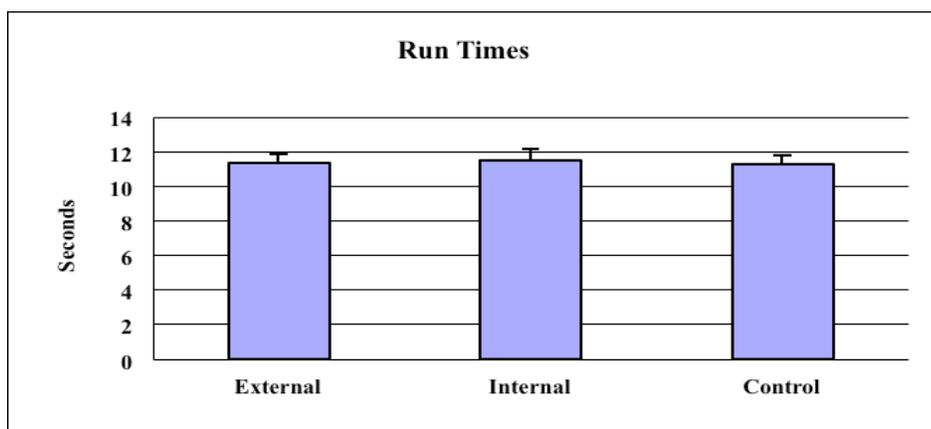


Figure 2. Average run times for each condition. Error bars represent standard deviation.

## Discussion

The effects of using verbal instructions designed to elicit an external, internal, and neutral focus of attention while performing a complex whole-body agility task using a skilled population were addressed in the present experiment. The results of this study did not support the prediction

that using an external focus would result in improved agility performance as indicated by a faster movement time. While the difference in average run times between the conditions were not significant, the results are meaningful in the context that the findings are not consistent with past research, indicating their may be limitations to the generalizability of adopting an external focus of attention.

This study makes a unique contribution to the field of strength and conditioning as well as motor behavior in that it displays how the manipulation of simple verbal instructions did not impact skilled athletes' performance of a complex agility task. Past research in the area of attentional focus has been primarily limited to expert and novice performers ability to perform object manipulation based tasks such as golf ball chipping (Wulf & Su, 2007), free-throw shooting (Al-Abood et al., 2002) and volleyball serve placement (Wulf et al., 2002, Exp 1). Additionally, research has also been conducted on balance performance (Shea & Wulf, 1999), as well as jumping and power based skills via the vertical jump (Wulf et al., 2007), and standing long jump (Porter, Ostrowski et al., 2010). Previous studies also included the use of whole body agility tasks (Porter, Nolan et al., 2010), but the subjects were non-experts and therefore it is probable they did not possess the same level of agility and movement automaticity as the expert performers in the present study. Even though the participants of this study may not have been skilled at the "T"-test specifically, tennis itself is a sport that requires agility and the participants in the present study compete at a level that is the highest in all of intercollegiate athletics (i.e., Division I). Based on the research discussed above, it was predicted that verbal cues eliciting an external focus would produce superior agility times compared to the control and internal focusing conditions. However, the results of the present study do not support this expected outcome. Consequently, this study lays the framework for future research to be conducted in the

area of attentional focus and its applications to elite performers partaking in more complex whole body tasks requiring a variety of locomotive and agility based skills.

There are limitations to the current findings, many of which highlight the necessity for continued research on the frontier of motor behavior and its role in verbal instructions and athletic performance amongst skilled performers completing tasks that require agility. For example, this study had a relatively small sample size ( $N = 8$ ), and only tested college-aged female athletes from one particular sport (i.e., tennis). Through testing larger numbers of both male and female athletes involved in a variety of high-level sports, future research may gain a broader understanding of how these factors interact with findings presented in previous experiments. To the knowledge of the researchers involved in the current study, no current evidence exists as to whether any significant differences exist between genders in regards to attentional focus manipulation on performance. Additionally, future research should utilize a between-participant design as well as implement retention and transfer tests following practice rather than measuring immediate results. Previous research has demonstrated that practice groups were not significantly different, however participants in those studies that received external focusing instructions during practice did display superior performance on later post-testing (Wulf, McNevin et al., 2001). Because of this possibility, future research utilizing measures of learning are needed to fully understand the possible influences the prescribed instructions had on behavior. The final suggestion is that future research should utilize a questionnaire after the completion of each protocol. The questionnaire would divulge what the athlete was truly focusing on during the course of the procedure or whether after listening to the different verbal cues during each trial, they simply ignored the prescribed instructions and resorted back to a “default” focus of attention for each of the experimental conditions. If this were the case it would

provide a plausible explanation for the lack of significant differences between the three conditions in the present study.

It may be theorized that no difference was observed in performance under the external focus condition because the performers in this study were skilled athletes who already have developed a highly tuned system that developed as a function of years of practice. This theoretical explanation would suggest that there may be a limit to the performance-enhancement benefits that accompany the adoption of an external focus since the development of such a highly tuned system may allow for movement errors to be corrected more quickly, and each movement itself is already automated at a high-level. This conclusion is consistent with Wulf's (2008) study which showed that skilled acrobats performing a balance task on a rubber inflated disc saw no difference in postural sway amongst the three attentional focus conditions, but did find that the performer's movement adjustments were higher under the control condition, thus suggesting that they already have a highly adaptable motor system as it pertains to the task.

A more practical explanation for the results in this study would be that even though the athletes in the present study were highly skilled tennis players, implying they possess a high level of agility, their relative unfamiliarity with the task itself might have impacted their performance as well as their retention of the verbal cues given. While the "T"-test is commonly used to assess agility performance in tennis athletes (Seminick, 1990), it cannot be assumed that each athlete in the present study has been exposed to the "T"-test prior to this study. Furthermore, since the task may have been novel to them, they may have been more focused on the correct performance of task itself as opposed to the attentional foci that the cues were designed to elicit, thus potentially negating any positive effects of any of the three conditions.

Through gaining a better understanding of how the verbal cues that practitioners give their athletes before, during or after training may impact their athletes performance of a skill or task, coaches can better tailor their instructions in a way that may allow for improved performance. By giving a novice athlete more simplified verbal cues that allow him/her to focus on the outcome of the movement rather than the precise details of the movement itself, the athlete's motor system may be better able to self-organize, thus reducing interference and "paralysis by analysis" which could save the coach, athlete, and institution time, money or other resources dedicated towards training. This may also be a concern in clinical rehabilitation settings and may even lead to a reduced rate of injuries in sports or activities including, but not limited to snow-boarding, wind-surfing, race-car driving, gymnastics, or football (McNevin, Wulf, & Carlson, 2000). Also, once an athlete becomes more familiar with which form, level or amount of cues seem to work best for them the coach and athlete may be better at individualizing the instructions given for tasks which would save time and potentially further optimize motor performance in that particular athlete.

The results of this study add to the growing body of research on attentional focus and its impact on performance. The use of verbal instruction is a daily variable used by coaches around the world that enables them to communicate complex ideas, strategies and maneuvers with athletes in order to enhance their performance on the chosen field of play, change behaviors, and to guide them to better adapt to any task they may face in their particular arena. Coaches and athletes worldwide are always searching for a competitive edge on their opponents. And while training methods and nutrition are certainly important, the data reported in this experiment along with the previous research highlighted in this study, illuminate the impact that verbal interaction

between coaches and their athletes has in regards to the athletes ability to perform complex skills.

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