2010

Focus of Attention Influences Elite Athletes Sprinting Performance

Blake A. Sims
siu850031128, b4sims2@siu.edu

FOCUS OF ATTENTION INFLUENCES ELITE ATHLETES SPRINTING PERFORMANCE

By

Blake Sims

Bachelors of Science, Southern Illinois 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
December 2010

RESEARCH PAPER APPROVAL

FOCUS OF ATTENTION INFLUENCES ELITE ATHLETES SPRINTING PERFORMANCE

By

Blake Sims

A Research Paper Submitted in Partial

Fulfillment of the Requirements

for the Degree of

Masters of Science

Department of Kinesiology

Approved by:

Jared M. Porter, Ph.D., Chair

Julie A. Partridge, Ph.D.

Graduate School
Southern Illinois University Carbondale
November 5, 2010

AN ABSTRACT OF THE RESEARCH PAPER OF

BLAKE SIMS, for the Master of Science degree in EDUCATION, presented on NOVENBER 5, 2010, at Southern Illinois University Carbondale.

TITLE: FOCUS OF ATTENTION INFLUENCES ELITE ATHLETES SPRINTING PERFORMANCE

MAJOR PROFESSOR: Jared M. Porter Ph.D.

The main objective of the current experiment was to test predictions of two competing theories on focus of attention using an 18.29 m sprint task with a highly trained population. The first prediction was based on the constrained action hypothesis (Wulf, McNevin, & Shea, 2001), and proposed sprinting performance would be enhanced in an expert population when adopting an external rather than an internal focus or no specific focus of attention. The second prediction was based on an alternative line of investigation, and proposed that adopting a skill focused attention would depress motor performance in an expert population compared to a control set of instructions not designed to induce a specific focus of attention. Participants ($N = 9$) completed nine total trials following instructions that were designed to elicit an internal (INT) focus, external (EXT) focus, and a control (CON) set of instructions inducing no specific focus of attention. The analysis revealed that the results partially supported the second prediction. Specifically, participants ran the second portion of the sprinting task faster when they were following the CON instructions compared to when they were following the INT and EXT instructions, which both directed attention to the skill. These results suggest that elite athletes should not be instructed to focus internally or externally on the task when performing a short distance sprint.

ACKNOWLEDGMENTS

First and foremost I must praise God, without the Lord's constant faith and blessings on this journey I know none of this would even be remotely possible. I would like to thank Brad Taylor and Saluki Athletics for accepting me as the Saluki Athletics Intern thus providing me with the opportunity to pursue my masters' degree. It was a great experience and I will carry the lessons learned for life. To Dr. Porter, thank you for your time and patience through this process. I truly appreciate your guidance and wisdom. Also thank you to Dr. Partridge for agreeing to be the second reader and approving the paper.

I would like to thank my family for their constant support and motivation through my entire college career, especially during the most difficult times. Mom you were the driving force behind me making to this point in my life, love you. Dad I appreciate you being there since day one, I realize it more now than ever. To my many older siblings (to many to mention, love all of you) thank you for keeping focused on the big picture in life.

To my four grandmothers (Grandma Daisy, Granny, Grandma Sims (R.I.P) and Grandma Hoelscher (R.I.P)) and all my aunts, uncles and cousins on all sides of the family, thank you for your inspiring words and supports that you have provided me with during my pursuit for higher education. I must give a huge "thank you" to Jerry Kill for providing me with a second chance at school and football. Without your decision to allow me to play for you I would be nowhere close to the person I am today. I would also like to thank Coach Jay Sawvel, I will never forget you using me as an example in meetings saying I am someone who will be successful in whatever I do. That statement assured me

I can do whatever I want to in life. In closing I would like to thank the entire community of Southern Illinois for providing a welcoming environment.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

Imagine if you could improve an individual's athletic performance just by modifying a few words in your verbal instructions. Typically you hear something similar to the following statements when a person is instructed how to shoot a basketball free throw. Stand with feet shoulder width apart, keep shoulders parallel to the target, slightly bend your knees and waist, bend your elbow, spread your fingers wide around the ball, and flick your wrist upon release of the ball. The instructions provided in this example are very specific to component parts of the skill, and emphasize how the body should be positioned and how it should move. Instructions similar to these have been used for many years to teach free throw shooting as well as many other skills. Coaches are constantly looking for different ways for their players and/or teams to gain a competitive advantage. Often times these advantages are gained through strength and conditioning regimes or through practice schedule design considerations. In addition, motor learning research has also demonstrated that coaches can immediately improve athletic performance by simply altering the way instructions are delivered to their athletes (Wulf, 2007). However, research conducted by Williams and Ford (2009) revealed that it is not common for coaches to embrace the suggestions made by scientists who research motor learning. One explanation for this is that most research is theoretically based and has very limited application to real world sport settings, especially when dealing with elite athletes (Ericsson & Williams, 2007). Two questions likely not considered by many coaches are; what is the result when an athlete receives a specific set of instructions, and are there alternative instructions that would produce more effective results?

Verbal instructions are commonly used by coaches to deliver critical information to athletes in testing, and training contexts (Marchant, Greig, & Scott, 2009). In recent years there has been growing evidence that an individual's focus of attention has a significant influence on motor skill performance and learning (Wulf, Zachry, Granados, & Dufek, 2007). Previous research has consistently demonstrated that manipulating a performer's focus of attention through the use of verbal instructions can have a considerable influence on a performer's quality of movements and, in turn, motor skill performance (Marchant et al., 2009). Instructions that induce an external focus direct attention to the effect the movement has on the environment (Wulf & Prinz, 2001). Such instructions have been shown to be more effective for both novice and expert performers than those that induce an internal focus, which directs attention to the movements of the body (Wulf & Prinz, 2001). These findings support the predictions of the constrained action hypothesis (Wulf, McNevin, & Shea, 2001). According to this view, focusing attention on the movement effect (i.e., external focus) promotes an automatic mode of movement processing. The performer is allowed to focus on the outcome goal and is able to naturally select the most efficient way to successfully complete the task. In contrast when individuals try to consciously control their movements (i.e., adopt an internal focus) they tend to constrain the motor system by putting too much attention on specific steps and body positions needed to complete the task. By constraining the motor control system, automatic motor behaviors are disrupted which results in depressed motor performance for both novice and expert performers (Wulf, 2007).

Attentional focus research is gaining more and more interest and is starting to expand out of controlled laboratory setting to more real-world contexts. As evidence of the benefits of attentional focus expands, so do the questions about its effects. When this line of investigation first began, most research looked primarily at sport skills that required the learner to successfully manipulate an object (Porter, Nolan, Ostrowski & Wulf, in press). For example, studies have shown that golf shot accuracy (Wulf & Su, 2007) and free throw accuracy (Zachry, Wulf, Mercer, & Bezodis, 2005) can be improved by adopting an external rather than internal focus. However, many practitioners teach skills that do not require object manipulation but require whole body movements (e.g., sprinting, jumping, agility). Moreover, these types of skills are often used to evaluate athletic performance. Recently researchers have expanded attentional focus research to test whether the same effects apply to skills that do not require object manipulation. Adopting an external focus has been shown to improve balance performance (McNevin, Shea, & Wulf, 2003; Shea & Wulf, 1999)), vertical jump (Wulf et al., 2007), standing long jump (Porter, Ostrowski, Nolan & Wu, 2010), and agility (Porter et al., in press).

In a recent study by Porter et al. (2010) attentional focus instructions were tested by participants completing a standing long jump. Participants were assigned to one of two groups with equal numbers of men and women in each group and statistically similar body height and weight. Each participant completed a total of five jumps with a two minute seated rest between each trial. Before every trial each participant was read a set of instructions designed to induce a prescribed focus of attention. The internal instructions were “when you are attempting to jump as far as possible, I want you to focus your attention on extending your knees as rapidly as possible.” The external instructions were “when you are attempting to jump as far as possible, I want you to focus your attention on jumping as far past the start line as possible.” Results revealed that the external group jumped significantly father compared to the internal group.

Another recent study by Porter et al. (in press) revealed similar results. Using a within participant design, 20 untrained young adults were recruited to complete an agility "L" run. Each participant ran five maximum effort trials under a control, internal, and external condition. Each set of trials for each condition was performed on separate non-consecutive days of the week (i.e., Monday, Wednesday, and Friday) at the same time each day. On day one all participants ran the control condition to take away the chance they would be influenced by the internal or external instructions they received on a previous day. The order of the internal and external conditions was counterbalanced across days two and three for all participants. Before testing began all participants completed a five-minute dynamic warm up by walking brisk laps around the gym where the test was conducted. A two minute seated rest was administered after the demonstration and again between each trial. Subjects were read instructions corresponding to the specific condition before every trial. The control group was told to "run through the course as quickly as you can with maximum effort." For the internal group instructions were to "run through the course as quickly as possible with maximum effort. This test consists of two parts, a running component and a turning component. For each running component, I want you to focus on moving your legs as rapidly as possible. For the turning component, I want you to focus on planting your foot as firmly as possible." The external group instructions were to "run through the course as quickly as possible with maximum effort. This test consists of two parts, a running component and a turning component. For each running component, I want you to focus on running towards the cone as rapidly as possible. For the turning component, I want you to focus on pushing off the ground as forcefully as possible." Results revealed that when given the external set of instructions, times were significantly faster compared to the internal and control conditions.

There is consistent research showing the benefits of adopting an external focus over an internal focus during skill execution (Wulf, 2007). However, this line of investigation does not answer all of the questions related to the content and structure of verbal instructions. An examination of the experimental research indicates that the answer to these questions predominantly depends on how researchers have defined the different possible attentional foci a skilled performer could have (Castaneda & Gray, 2007). A separate group of studies using baseball hitting (Castaneda & Gray, 2007; Gray, 2004) looked at skilled versus environmentally focused attention. Skill focused attention is attention to any aspect of the motor action (e.g., position of hands or feet, movement of the bat). While environmentally focused attention is attention to anything in the environment not directly involved in skill execution (e.g., the position of the infielders or noise from the crowd). In both studies (Castaneda & Gray, 2007; Gray, 2004) the skill versus environment focus of attention was tested using a baseball batting simulation. In the study conducted by Gray (2004), the skill focused attention group focused on the movement of the bat and the environmentally focused attention group attended to the frequency of an auditory tone. The findings showed performance was degraded for highly skilled baseball players in the skill focused condition (i.e., focusing on the movement of the bat) because they focused on component steps of the skill. No statistical differences from baseline were found when the experts adopted an environmental focus. Results from Castaneda and Gray (2007) revealed that experts batting performance was significantly degraded when encouraged to adopt a skill focused attention (i.e., movement of the hands or movement of the bat) compared to adopting an environment focus of attention (the ball leaving the bat or auditory tones). Castaneda and Gray (2007) concluded that focusing on the skill degraded expert performance because it caused them to consciously focus on the step by step components of the skill which interfered with the automatic processing of working memory.

Consistent with the aforementioned (Castaneda & Gray, 2007; Gray, 2004) line of investigation, Beilock and colleagues (Beilock, Carr, MacMahon, & Starkes, 2002; Beilock, Wierenga, & Carr, 2002) presented similar results for both golf putting and soccer ball dribbling. These lines of investigation present an alternative view to Wulf's work on internal versus external focus of attention. The skill of hitting a pitched baseball can be used to illustrate the theoretical differences between these competing lines of experimentation. According to Gray and colleagues, and Beilock and colleagues, if a learner focuses on their hands, feet, or movement of the bat they would be focusing on the skill, which should result in depressed motor performance in expert populations. However, according to Wulf, when hitting a baseball focusing on the hands or feet are considered an 'internal' focus and focusing on the movement of the bat is an 'external' focus. According to Gray and Beilock, if a skilled baseball player were told to focus on the movement of the bat when hitting a baseball the expert would suffer from decreased performance because the movement of the bat is 'skill' focused. However, according to Wulf the skilled baseball player would benefit from this type of instruction because focusing on the movement of the bat is considered an external focus, which promotes an automatic mode of movement compared to an internal cue such as the movement of the hands when swinging the bat. To date, there has not been a direct empirical comparison of these two forms of verbal instructions in a skilled population performing a well learned task that does not required the successful manipulation of an object.

The purpose of this experiment was to test competing predictions made by both of these lines of investigation. The specific aim of this study was to investigate how verbal instructions designed to focus attention internally, externally and/or to the skill influence the performance of a well-learned task in an expert population. If the underlying mechanisms of the constrained action hypothesis are correct (Wulf et al., 2001), it was expected that directing attention externally rather than internally would improve the motor performance of a well-learned task. However, based on the work of Gray (2004) and Beilock (2002), it was expected that directing attention to the task, be it internally or externally, will equally depress motor performance in an expert population performing a well-learned task compared to a control condition, which allows the participant to choose their own focus.

METHOD

Participants

Nine healthy, highly skilled collegiate football players (*M* age = 21.11 years, *SD* = 1.22; *M* height = 182.04 cm, *SD* = 4.25; *M* weight: 93.24 kg, *SD* = 36.23) were recruited for this study. Participants played competitive American football for at least seven years prior to their involvement in this study. Furthermore each player had been recruited out of high school and received a full athletic scholarship to play Division I American football. At the time of data collection, all participants were listed on Southern Illinois University's (SIU) football roster and had been in the program for at least two years. All participants were actively involved for multiple years in an organized strength and conditioning program. Because of this involvement all participants had received training in running form and technique from strength and conditioning professionals. They had also been tested multiple times in a 40 yard dash test which made them familiar with the sprint test and timing apparatus used to conduct the current study. Each participant played what is considered a "skill" position on the football team; which includes the following positions: wider receiver, defensive back, running back and linebacker. All participants were recruited by a member of SIU's strength and conditioning staff, signed informed consent forms, and filled out a medical history questionnaire prior to data collection. All experimental methods and forms were approved by the University's Institutional Review Board prior to data collection.

Apparatus

Electric timing gates (Brower Timing System, model IRD-T175) were used to record time at the 10 and 20 yard mark (9.14 and 18.29 m respectively). The laser timing gates were set up on tripods at waist level. A total of four gates were used; two at the 9.14

m mark and two at the 18.28 m mark. The timing gates were set up parallel to the start and finish lines, which were marked with colored tape on a hard wood gymnasium floor. There was a pedal at the start line, which participants placed their hand when they were ready to run. Once the hand left the pedal the time started. Times were recorded to a wireless hand held device when the participant broke the laser signal at the 9.14 m mark and again at the finish line.

Task and Procedure

For the 18.29 m dash test, each participant completed three trials under each condition using a within participant design. The control (CON) condition received no attentional focus directing instructions; they were simply told to “run the 20 yard dash with maximal effort.” The internal/skill (INT) focus condition was told “while you are running the 20 yard dash with maximum effort, focus on gradually raising your body level. Also, focus on powerfully driving one leg forward while moving your other leg and foot down and back as quickly as possible.” The external/skill (EXT) focus condition was told “while you are running the 20 yard dash with maximum effort, focus on gradually raising up. Also, focus on powerfully driving forward while clawing the floor as quickly as possible.” Data were collected over a two day period. On day one, all participants completed the CON condition. Everyone ran the control group first to eliminate the chance of the participants thinking about the details given in the internal and external condition. On day two, participants ran both the INT and external CON. The order of practice trials on day two were counterbalanced to control for order effects. Participants were taken through the same five minute dynamic warm-up prior to the beginning of testing each day. The warm up was conducted by a qualified member of the

University's strength and conditioning staff. The dynamic warm up included whole body activities such as high knees, lunges, power skips and 5 m sprints followed by a short jog. Two minutes of active rest (i.e. relaxed walking) was administered between warm-up and first trial and between all practice trials each day. The appropriate instructions were read to each participant prior to each practice trial for each day of practice. Participants were allowed to ask questions if the instructions were not clear.

Dependent Variable

The dependent variable consisted of three sets of times representing sprinting ability. The three sets of times were the first 9.14 m split, the second 9.14 m split, and the whole 18.29 m run. Times for the first 9.14 m split and whole 18.29 m dash were captured automatically with infrared timing gates. The second 9.14 m split was not directly captured by the infrared timing gates; rather it was calculated by subtracting the first 9.14 m split from the total 18.29 m time. Movement time began when participant's hand left the pedal at the start line and stopped when they crossed the beam at 18.29 m. Participants began the run at their own discretion.

RESULTS

Eleven participants were originally tested in this experiment; however data representing two of the participants were removed because they were statistically determined to be outliers. Times in the 18.29 m dash were analyzed using a 3 x 3 (Focus of attention: CON, INT, EXT x 1st split, 2nd split, total time) one-way analysis of variance (ANOVA). Each trial was broken down into three measurements; first 9.14 m split, second 9.14 m split, and the full 18.29 m dash. There were no significant differences between conditions in the first 9.14 m split $F(2, 78) = 0.030$, $p > 0.971$ for the CON (M =1.78s; SD = 0.05), INT (M = 1.78s; SD = 0.05), or EXT condition (M = 1.78s; SD = 0.06) (see Figure 1).

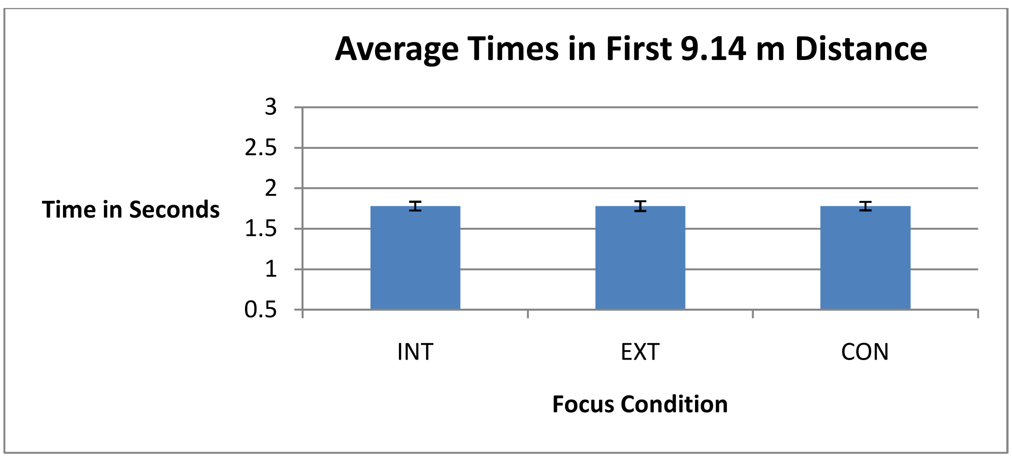

Figure 1. Average movement times in the first 10 yards (9.14 m)

There were no significant differences between conditions at the 18.29 m distance $F(2,78) = 0.516$, $p > 0.599$ for the CON (M = 2.90s; SD = 0.07), INT (M = 2.92s; SD = 0.06), EXT (M = 2.92s; SD = 0.07) (see Figure 2).

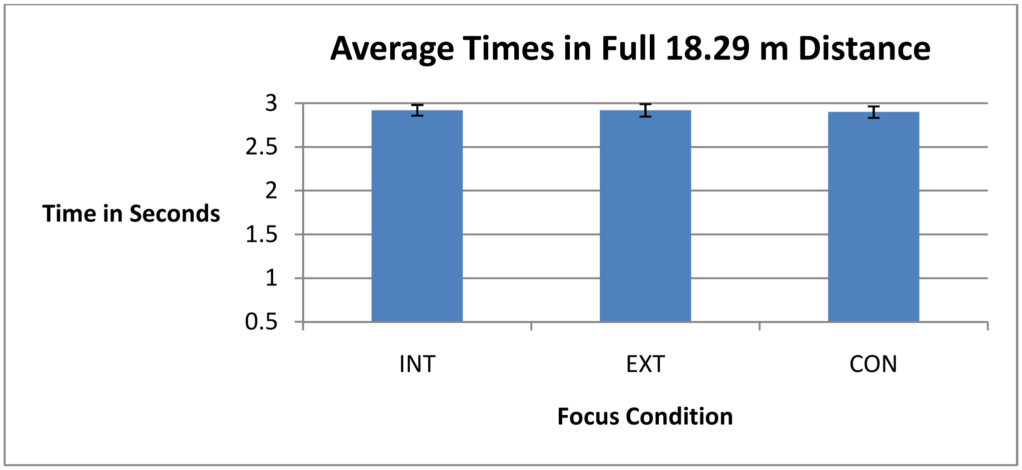

Figure 2. Average movement times for the whole 20 yard (18.29 m) dash

However there was a significant main effect for condition in the second 9.14 m split $F(2,78) = 3.182$, $p < 0.047$ CON ($M = 1.12$s; $SD = 0.04$), INT ($M = 1.14$s; $SD = 0.03$), EXT ($M = 1.14$s; $SD = 0.03$) (see Figure 3).

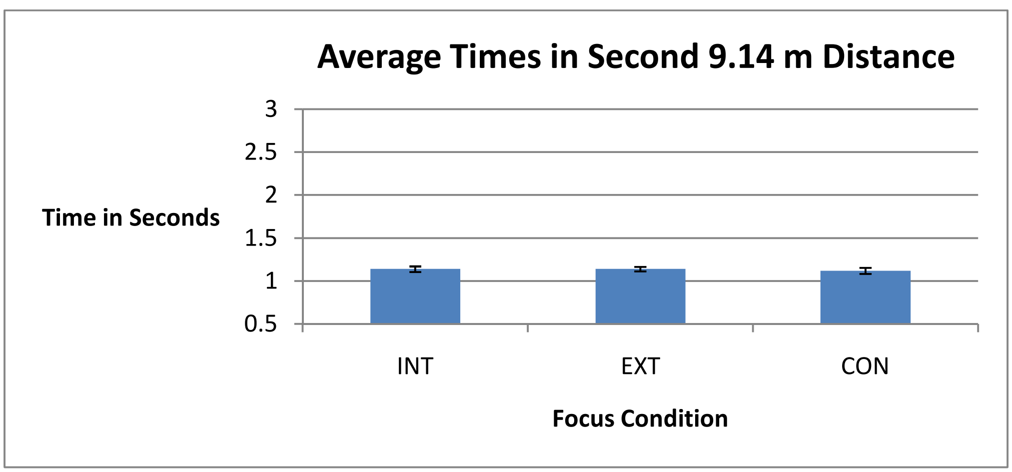

Figure 3. Average movement times in the second 10 yards (9.14)

A Tukey LSD post hoc analysis revealed that times in the second 9.14 split for the CON group ($M = 1.12$s $SD = 0.04$) were significantly faster than both the INT ($M = 1.14$s $SD = 0.03$) and EXT ($M = 1.14$s $SD = 0.03$) condition.

DISCUSSION

The purpose of the current experiment was to test two competing focus of attention theories proposed by Wulf et al. (2001) and Beilock et al. (2004) using a highly skilled sprinting population. The specific aim was to look at how focusing attention internally, externally on the skill, or the use of no specific focus influenced sprinting performance. In order to do this each participant completed three trials of the prescribed task under each of the three conditions (i.e. control, internal, and external), totaling nine trials per person. Based on the constrained action hypothesis (Wulf et al., 2001), it was predicted that directing attention externally rather than internally would improve motor performance. However, based on the work of Gray and colleagues (2004), and Beilock and colleagues (2002), it was predicted that directing attention to the task, be it internally or externally, would equally depress motor performance in an expert population performing a well-learned task.

The results of this experiment do not support the predictions of the constrained action hypothesis (Wulf et al., 2001), which proposes that adopting an external focus elicits superior results compared to an internal and control group. However, the results of this study partially support research findings reported by Beilock et al. (2002), Gray (2004), and Castaneda & Gray (2007) which propose that when dealing with an expert population you do not want to direct attention to the skill. These authors suggest doing so interrupts the process of procedural knowledge and the motor control processes associated with working memory. Specifically, Beilock et al (2002), Gray (2004), and (Castaneda & Gray 2007) propose when dealing with a highly trained population using skilled focus attention (i.e. attention to any aspect of the motor action) will be harmful to performance because it directs the performer to concentrate on a step by step approach to completing the motor skill. Castaneda and Gray (2007) suggest that in order to optimize results in expert performance, attention should be directed in a way that "does not interrupt the process of proceduralized knowledge" (p. 60). For the task of sprinting it seems one way to accomplish this amongst an expert population is to not provide any focus of attention directing instructions. During the second 9.14 m split subjects were significantly faster in the control condition compared to the internal and external conditions. The control group didn't receive verbal instructions designed to induce an environmental or skill focus of attention. Rather, they were simply told to "run the twenty yard dash with maximum effort." This type of instruction likely did not interrupt the athlete's process of proceduralized knowledge, which is a plausible explanation why the expert participants were significantly faster in the control condition. Not providing specific instructions may allow the expert to choose the most instinctive and efficient way to complete the task. The findings reported by Beilock et al. (2002) and Gray (2004) further suggests that expert's attention should be directed towards features in the environment. This type of attention can be achieved by delivering an environmentally focused set of instructions (i.e. attention to anything in the environment not directly involved in the skill). The current study did not test the efficacy of directing attention to the environment when performing a well-learned task; more research is needed to test the validity of this suggestion.

This study makes a unique contribution to the field of strength and conditioning because it highlights a question not commonly asked amongst professionals; what are the best attentional focus instructions to give to a highly trained athlete to produce peak sprinting performance? Usually these instructions will include one or more words that direct the athlete to focus their attention. For example, a coach working with a sprinter may say “stay low coming out of the start, drive forward forcefully as you gradually rise up and run all the way through the line.” These cues will likely induce some level of skill-focused attention, which may disrupt the athlete’s natural motor program selection process resulting slower sprinting ability. When involved in a test situation (e.g., 40 yard dash, 100m Olympic finals) coaches should consider only giving verbal cues that do not interrupt an athlete’s proceduralized knowledge, enabling the best chance for ideal performance.

For the last ten years researchers have intensely investigated the influence of attentional focus on motor skill performance. As stated above, previous studies have investigated the effects focus of attention has on a variety of whole body movements, such as vertical jumping (Wulf et al., 2007), the standing long jump (Porter et al., 2010), and agility (Porter et al., in press). The results of these experiments indicated that performance under an external focus resulted in the best measures for the participant compared to an internal focus or control condition. The current study is the first to test the benefits of inducing an external focus compared to an internal focus and control group for the task of sprinting, and one of a few studies to explore these factors in a highly trained population. The results of this study were not consistent with predictions of the constrained action hypothesis (Wulf et al., 2001); however, a meaningful finding was observed. Specifically, the results partially support findings by Beilock et al. (2002), Gray (2004), and Castaneda & Gray (2007). Although the control group was not given any environmentally focused attention cues, the instructions given in the internal and external conditions likely induced a skill-focused attention, which may have disrupted proceduralized knowledge resulting in depressed motor performance. This experiment reveals that coaches who deal with a highly trained sprinting population should carefully choose how they deliver instructions when runners are being tested and be careful not to provide cues that reference the body or the task.

Sprint tests are commonly used to evaluate athletic performance. For example, in the National Football League (NFL) sprint times in the 40 yard dash and can mean the difference between a high and low draft pick and millions of dollars in salary. NFL prospects spend endless hours and large amounts of money to get the best training so they can have an optimal performance when tested. Because of this, it is expected and imperative that coaches provide their athletes with the most effective instructions to enable the best performances of their athletes. The present study demonstrates that instructions that direct attention to the task, either internally or externally should be avoided on testing days so the trained sprinter can produce their best performances.

For future research it is encouraged that the study include test with longer distances. Only seeing results in second 9.14 m split suggest that the influence of the instructions were only effective during the running phase of the test and not the start which is likely controlled by a separate set of motor abilities. It would be beneficial for researchers to test the current results in a 40 yard dash and the 100 m dash; both of which are more common distances used to measure sprinting ability in many sports. If these tests produce similar results, it would support the conclusion that only providing instructions that do not reference the task are best for trained athletes performing maximum effort sprints. Furthermore, future research should include larger sample sizes and athletes who are involved in other sports. In addition, it would be valuable to use similar methods to test untrained sprinters to see if the findings observed in the current study generalize to less skilled populations. Lastly it may also be beneficial to give the participants equal amounts of rest between conditions. In this experiment the control condition was conducted on the first day and the remaining conditions were both conducted the following day. A better method of investigation would be to conduct the experimental trails over three consecutive days or with one day of rest between each condition over a five day period. Unfortunately constraints of the samples population did not allow this methodology in the current study.

The data reported in this experiment suggest when dealing with a highly skilled sprinting population strength and conditioning professionals must pay close attention to the verbal instructions they provide. Coaches should issue instructions that do not promote a skill-focused attention. Given the complex mechanical nature of efficient sprinting, coaches may assume it is critical to provide instructions to athletes that reference the movement of the body when running. In fact, a recent study conducted by Porter, Wu, and Partridge (2010) looked at focus of attention and verbal instructions strategies of elite track and field coaches and athletes. A survey of thirteen participants competing in the USA Track and Field Outdoor Championships revealed that in practice settings coaches gave instructions that induced an internal focus of attention (i.e., focusing on body and or limb movements) 84.6% of the time. There are times in practice when it may be necessary to provide instructions that reference the body, in fact under some circumstances referencing the body or the task may be unavoidable. However the skill of sprinting is so well learned in a highly trained population that putting emphasis on the smallest skill related detail during testing sessions could be harmful to the outcome. To eliminate the chance of influencing skill focused attention coaches can give cues such as: be explosive, be forceful, be powerful, run with great force, run with great power and run with maximum effort. Providing these types of verbal instruction will likely allow the athlete to run using proceduralized knowledge giving the athlete the best chance at optimal performance. Doing this allows the athlete to naturally select the most efficient and effective motor program to complete the task.

REFERENCES

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

Beilock, S. L., Wierenga, S. A., & Carr, T. H. (2002). Expertise, attention, and memory in sensorimotor skill execution: Impact of novel task constraints on dual-task performance and episodic memory. *The Quarterly Journal of Experimental Psychology, 55 A*, 1211-1240.

Castaneda, B., & Gray, R. (2007). Effects of focus of attention on baseball batting performance in players of differing skill levels. *Journal of Sport & Exercise Psychology, 29*, 60-77.

Ericsson, K. A., & Williams, A. M. (2007). Capturing naturally-occurring superior performance in the laboratory: Translational research on expert performance. *Journal of Experimental Psychology: Applied, 13*, 115-123.

Gray, R. (2004). Attending to the execution of a complex sensorimotor skill: Expertise differences, chocking, and slumps. *Journal of Experimental Psychology, 10*, 42-54.

Marchant, D., Greig, M., & Scott, C. (2009). Attentional focusing instructions influence force production and muscular activity during isokinetic elbow flexions. *Journal of Strength & Conditioning Research, 23*, 2358-2366.

McNevin, N. H., Shea, C. H., & Wulf, G. (2003). Increasing the distance of an external focus of attention enhances learning. *Physiological Research, 67*, 22-29.

Porter, J. M., Ostrowski, E. J., Nolan, R. P., & Wu, W. F. (2010). Standing long-jump performance is enhanced when using an external focus of attention. *Journal of Strength and Conditioning Research , 24*, 1746-1750.

Porter, J. M., Nolan, R. P., Ostrowski, E. J., & Wulf, G. (In press). Instruction that promote an external focus of attention benefit agility performance. *Frontiers in Movement Science and Sport Psychology.*

Porter, J. M., Wu, W. F. W., Partridge, J. A. (2010). Focus of attention and verbal instructions:

strategies of elite track and field coaches and athletes. *Sport Science Review*, *19*, 199-211.

Shea, C. H., & Wulf, G. (1999)). Enhancing motor learning through external-focus instructions and feedback. *Human Movement Science, 18*, 553-571.

Wulf, G., (2007). Attentional focus and motor learning: A review of 10 years of research. In E.-J. Hossner & N. Wederoth (Eds.), Gabriele Wulf on attentional focus and motor learning [Target article]. *E-Journal Bewegung und Training, 1*, 4-14. Retrieved from http://www.ejournal-but.de.

Williams, A. M., & Ford, P. R. (2009). Promoting a skills-based agenda in Olympic sports: The role of skill-acquisition specialist. *Journal of Sports Sciences, 27*, 1381-1392.

Wulf, G., Zachry, T., Granados, C., & Dufek, J. (2007). Increases in jump-and-reach height through an external focus of attention. *International Journal of Sports Science & Coaching, 2*, 275-284.

Wulf, G., & Prinz, W. (2001). Directing attention to movement effects enhances learning: A Review. *Psychonomic Bulletin & Review, 8*, 648-660.

Wulf, G., McNevin, N., & Shea, C. H. (2001). The automaticity of complex motor skill learning as a function of attentional focus. *The Quarterly Journal of Experimental Psychology, 54*, 1143-1154.

Wulf, G., & Su, J. (2007). An external focus of attention enhances golf shot accuracy in beginners and experts. *Research Quarterly for Exercise and Sport*, 78, 384-389.

Zachry, T., Wulf, G., Mercer, J., & Bezodis, N. (2005). Increased movement accuracy and reduced EMG activity as the result of adopting an external focus of attention. *Brain Research Bulletin, 67*, 304-309.

VITA

Graduate School
Southern Illinois University

Blake A. Sims Date of Birth: December 5, 1985

2008 S. Illinois Ave, Carbondale, Illinois 62903

202 Piper Blvd, Detroit, Michigan 48215

B4sims@yahoo.com

Southern Illinois University Carbondale
Bachelor of Science, Kinesiology, December 2008

Research Title:
Focus of Attention Influences Elite Athletes Sprinting Performance

Major Professor: Jared M. Porter, Ph.D.