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## Validation of Novel Software Program to Assess Coincidence Anticipation Timing

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VALIDATION OF NOVEL SOFTWARE PROGRAM TO ASSESS COINCIDENCE  
ANTICIPATION TIMING

Mallory J. Fritz

Master's Project

Submitted to the School of Human Movement, Sport, and Leisure Studies  
Bowling Green State University

In partial fulfillment of the requirements for the degree of

MASTER OF EDUCATION  
In  
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Project Advisor

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Mallory J. Fritz

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### Abstract

The purpose of this study was to evaluate a novel coincidence anticipation timing (CAT) software tool by leveraging the testing protocol employed by Brady (1996). Eighteen test participants (8 men, 10 women) were recruited from a Division I Mid-Western State University. Participants comprised two groups, open skills athletes (n=9) and non-athletes (n=9). The CAT task delivered by the software tool involved a small green dot that traveled across a computer monitor at one of four different speeds (0.46 mph, 0.69 mph, 0.92 mph, and 1.15 mph). On the right side of the screen was a small, white target dot. Participants were instructed to depress the spacebar the instant that the green dot reached the white target dot. Absolute error (ms), constant error (ms), and variable error (ms) were measured and compared within and between the test groups corresponding with both athletic experience and sex. Error measurements were analyzed using a 3-way factorial MANOVA design. Similar to Brady (1996), results showed open skills athletes performed with less absolute error than non-athletes. On average, women were least accurate at 0.92 mph compared to all other speeds. In accordance with Brady (1996), open skills athletes performed with less response bias (as evidenced by constant error) compared to that of non-athletes. A significant main effect was observed for the influence of speed on variable error, however subsequent post-hoc analyses did not demonstrate significance for any specific comparison. Participants were most variable at the 0.92 speed, and least variable at the 0.46 speed. In conclusion, the newly developed CAT software tool elicited performance outcomes comparable to those observed by Brady (1996). Future assessments should include an evaluation of the repeatability of the CAT software utility. Ultimately, the software-based CAT test may offer a more cost-effective and flexible assessment tool than traditional Bassin Timer devices.

*Keywords:* Coincidence anticipation timing, CAT, measuring CAT, assessing coincidence anticipation timing

### **Literature Review**

In order to successfully perform a variety of motor skills, an individual must make appropriate responses to target objects in motion, such as intercepting or catching a ball (Dunham, 1977). The ability to judge the trajectory of a moving stimulus and to organize a motor response so that the arrival at the target coincides with the arrival of the moving object at the same time is termed coincidence anticipation timing (CAT). CAT tasks range from shaking hands with another person, to picking up a cup from a table, to catching a ball. On a daily basis, humans react to various moving objects, which then produce catching, dodging, and interception responses (Fleury & Bard, 1985).

According to Stadulis (1972), two aspects of interception are implied by coincidence anticipation. The coincidence aspect of interception is when an individual makes a motor response at the exact same time a moving object arrives at a specified interception point. The second aspect, anticipation, is when an individual initiates a response before the arrival of the object at the interception point so that they can arrive at the point at the correct time (Stadulis, 1972). Anticipation is one of the most important aspects of a skilled motor performance, because an individual must predict first when an event will occur, and secondly he or she must allow for their own movement time in order to finish the response (Schmidt, 1969).

Speath-Arnold (1981) stated that a taxonomy of motor skills is a system in which motor skills are classified in regards to the characteristics of the movement involved, characteristics of the environment the skill was performed in, and the purpose of the skill. The taxonomy would provide a greater understanding of similarities and differences between different categories of motor skills. For example, fine motor skills are those skills where only certain body segments move within a limited area (Singer, 1975). Small muscle groups are responsible for producing

fine motor skills. Examples of such skills include writing, fastening buttons, tying shoe laces, and picking up change to name a few. On the other hand, gross motor skills are those skills that involve large muscles of the body (Singer, 1975). Many skills in sports are considered to be in the gross motor skills category. Examples of gross motor skills include walking, running, jumping, and sliding.

Skilled motor performances usually involve continuous movement and require an individual to anticipate an event, which means that reaction time of the individual may play a role in the anticipation of the event (Thomas, Gallagher, & Purvis, 1981). Whiting (1969) stated that reaction time is a limiting factor in the successful performance of skills. An individual's timing of a response is relative to the stimulus, which is considered to be an important characteristic of motor skill behavior (Van der Merwe & Du Randt, 1998). According to Singer (1975), a high degree of skill coincides with a high degree of timing and spatial precision, or accuracy of location in space. An individual will execute performances of motor skills within a certain time period, or else the task will not be completed.

Haywood (1980) outlined both speed and accuracy as two important factors in performing most motor skills and coincidence anticipation tasks. Isaacs (1983) stated that anticipation and timing are also critical factors responsible for the success of performing particular motor skills. For example, during interpersonal interactions with others, shaking hands requires an individual to correctly anticipate the timing of the other's hand in order to successfully perform the task. Not only is well developed coincidence anticipation required for daily activities, such as driving a car or crossing a busy street, but also well developed CAT is key in the performance of sports (Van der Merwe & Du Randt, 1998). For example, a baseball or softball outfielder must be able to correctly anticipate the flight path of a fly ball and where it

will land in order to position themselves in the necessary timeframe to perform the catch. Or, a soccer player must correctly anticipate a pass from a teammate before he or she is able to kick the ball to pass it to another teammate or attempt to score.

Examining potential performance-related qualities, such as classification groups of open skill and closed skill athletes and sex differences, within CAT may provide more insight to the factors that influence CAT function and task performance. When examining CAT, there are several variables that influence the timing. Van der Merwe and Du Randt (1998) list age, sex, practice, temporal (time) and spatial (location) predictability, fore-period interval, stimulus velocity, experience, and knowledge of results as variables that influence an individual's CAT. However, Ridenour (1977) stated that there are five dimensions that determine the successfulness of object-interception. The five dimensions include speed of the stimulus, direction of the object, size of the object, height in which the object is projected, and the distance in which the object travels. The CAT. Both of the variables that are the focus in this study raise questions, which, if answered, could lead to a better understanding of CAT.

The first question raised is whether or not there are differences in CAT between individuals who participate in open skill sports and those who participate in closed skill sports. Open skilled activities are externally paced tasks performed in a temporally and spatially changing environment (Brady, 1996). In addition to a changing environment, open skills are also characterized by various patterns of movement that occur (Speath-Arnold, 1981). Basketball, soccer, lacrosse, and tennis are all examples of sports that require open skills. A tennis player, for example, must react to their opponent, the speed of the ball, and the direction in which the ball is traveling in order to return the ball to their opponent, which is why it is considered an open skill sport. On the other hand, closed skills are those that are characterized by a stable environment



and the development of highly consistent patterns of movement (Speath-Arnold, 1981). With a stable environment, athletes can focus on the movement they want to execute, rather than focusing on the execution and the environment. Weight lifting, swimming, and track are all closed skill sports.

Little research has been conducted to strictly examine the differences between open skill athletes and closed skill athletes in CAT. Brady (1996) found that males who participated in open skill sports presented reduced absolute error at faster stimulus speeds compared participants who participated in closed skilled sports and non-athletes. Kuhlman and Beitel (1992) examined the role of open skilled sports on CAT, however, the experiment design served more to address experience level than the type of sport itself. In particular, they found that children who had prior experience with open skilled sports evidenced better accuracy than those who did not participate in open skilled sports (Kuhlman & Beitel, 1992). Del Rey, Wughalter, and Whitehurst (1982) and Del Rey, Wughalter, and Carnes (1987) examined CAT in college-aged women, some women had experience in open skill sports and some had little to no experience in sport at all. The results from those studies indicated that the women who participated in open skill sports had better CAT compared to the women with little to no experience. Landers, Boutcher, and Wang (1986) examined the connection between CAT and archery, a closed skill sport. Ultimately, they found there to be no connection between the timing and archery performance. With limited research, this study hopes to shed more light onto this variable impacting CAT.

A second question raised is whether or not there are in fact sex differences between males and females during CAT tasks. The most critical question specifically about sex differences in CAT is not the number of null findings, but rather the number of findings that favor each sex

(Sanders, 2011; Sanders, Sjodin, & Chastelaine, 2002). Overall, the research regarding sex differences in anticipation tasks provides conflicting results.

The most common findings in the literature suggest that males demonstrate a greater CAT accuracy compared to females (Blundell, 1982; Dunham, 1977; Kuhlman & Beitel, 1992; Payne, 1987; Rodrigues, Vasconcelos, Barreiros, & Barbose, 2009; Thomas et al., 1981; Watson & Kimura, 1989; Sanders, 2011). Although, several studies have found there to be no significant sex differences in anticipation tasks (Dunham & Reeve, 1990; Isaacs, 1983; Les, Katene, & Fleming, 2002; Diggles-Buckles & Bassin, 1990; Kuhlman & Beitel, 1989). On rare occasions, however, females have demonstrated better results compared to males (Sanders, 2011; Rodrigues, Vasconcelos, Barreiros, Barbosa, & Trifilio, 2009). Sanders (2011) also suggests that it appears males have an advantage over females in CAT across a range of ages (i.e. children, adolescents and adults).

Even though males tended to demonstrate improved CAT compared to females, those results are most commonly seen in absolute error and variable error (Sanders, 2011). Males many times do have better constant error results than females, but in some studies, females have had better constant error results than males (Sanders, 2011). Payne (1987) examined a group of 18-25 year olds to determine the effects of varying angle of the stimulus runway approach a CAT performance. Payne found that although the men had significantly less error as indicated by absolute and variable errors, the men had a higher constant error compared to the women. Rodrigues and colleagues (2009) examined the effects of handedness and sex differences on CAT. Like Payne's (1987) results, the results from Rodrigues and colleagues showed that males had better absolute and variable errors compared to females, while the females had better constant error results than the males.

Conversely, several studies have results contradicting the one discussed above. Several studies have failed to find any significant sex differences in CAT between males and females (Diggles-Buckles & Bassin, 1990; Dunham & Reeve, 1990; Isaacs, 1983; Kuhlman & Beitel, 1989; Williams et al., 2002). Isaacs attempted to answer at what age children are capable of performing hand closure around a ball within a certain time. He also examined the results for any possible sex differences in the anticipation tasks, but did not find any. Williams and colleagues examined sex differences, along with other variables impacting CAT, in tennis athletes. The results did not yield any significant sex differences between the male and female tennis athletes. Diggles-Buckles and Bassin examined the effects of subjects gaining knowledge of their results from the anticipation tasks. The results, similar to the previous two studies discussed, also showed no main effects for sex differences in absolute and constant errors.

When trying to determine potential reasons for why sex differences exist in CAT, one reason could be due to sociocultural training (Petrakis, 1985). Wrisberg, Paul, and Ragsdale (1979) explained why sociocultural training seems to be one potential reason why males usually have better CAT performances than females. Growing up, males are normally encouraged to develop athletically, while females are typically taught to behave in a feminine manner and to avoid most sports and vigorous activities (Wrisberg et al., 1979). Due to males generally being involved in athletics, it is plausible to assume that they are developing CAT through the practice of specific sports skills, whereas females may not practice sports skills if they are taught to avoid such activities.

The majority of research has used the Bassin Anticipation Timer (BAT) as a way to measure CAT and the amount of error participants produce by not having 100 percent accuracy. The BAT was established in the 1970s when it became the most favored instrument to measure

CAT ability (Van der Merwe & Du Randt, 1998). A BAT task requires the participant to be seated or standing at the end of a runway, which consists of small light-emitting diodes (LEDs). The participant then but push a button at the time in which he or she thinks the final LED light on the runway will be lit (Van der Merwe & Du Randt, 1998). Error results come from the participant pushing the button too early or too late. The downside to the BAT is that it is difficult to create tasks that replicate real world experiences. Very few studies have been able to examine CAT replicating real-world experiences, which can have an affect on laboratory research (Del Rey et al., 1987). According to Molstad and colleagues (1994), one variable that impacts CAT using the BAT is the length of the runway. Apparent motion or viewing time is directly related to the length of the runway (Molstad et al., 1994) and the length of time the participant has to estimate when the last LED will light up.

This is a replication study of Brady's (1996) research. The purpose is to examine if there are any differences in CAT between open skill athletes, closed skill athletes, and non-athletes. A second purpose is to also see if any sex differences are apparent within the classification groups. Since a new electronic measuring program has been developed to measure CAT, the third purpose is to validate the new measuring system.

### **Method**

Brady (1996) conducted a study that assessed CAT and differences between athletes who engage in open skills sports, athletes who engage in close skills sports, and non-athletes. Sex differences were also examined between groups. The current study represents a replication of Brady's (1996) investigation. One major difference, however, is how CAT is measured. Brady (1996) used a Bassin Anticipation Timer (Lafayette Instruments Co., Lafayette, IN) to measure participant's coincidence anticipation. The present study instead used a novel software program

to measure CAT. A second major difference between the two investigations is that Brady included a closed-skills group, where as this study only examines open-skills and non-athlete groups. Another difference between the two studies is that participants in the present study were recruited from a Division I NCAA state university, whereas participants in Brady's (1996) study were recruited from a Division II NCAA school. The purpose of this study was to replicate the Brady (1996) protocol with a novel software tool for the assessment of CAT. Finally, sex was identified as an independent variable to compare the CAT between men and women. The first hypothesis of this investigation was that small significant differences would be found when open skills athletes CAT is compared to the CAT of non-athletes. It was also hypothesized that no significant sex differences would be found between men and women.

### *Participants*

Eighteen healthy, adult undergraduate students were recruited from a Division I university to participate in the study. Inclusion criteria included the participants being between 18 and 30 years old, while being enrolled in at least one class at the university. Open skills athletes were defined as those who participate in football, basketball, lacrosse, soccer, ice hockey, volleyball, baseball, softball, and rugby. Each participant was given a questionnaire to evaluate the types of sports in which they engaged, and the extent to which they were competitive in those sports. The questionnaire was used to examine each participant's eligibility for the study. Nine participants (four men and five women) were chosen to represent the open skills athletes. Participants who have competitively played both open and closed skills sports during the previous three years were not included in the study. An additional nine participants with little-to-no competitive athletic experience were selected for the non-athlete control group.

The inclusion criterion for the non-athlete participants involved engaging in less than one hour of any physical recreation or organized sport per week.

### *Apparatus*

A novel software utility was developed for the evaluation of CAT. The CAT task delivered by the program involved a small green dot on the left side of the computer screen that moved at one of four different speeds (0.46, 0.69, 0.92, 1.15 mph) across the screen to the right. On the right side of the screen was a small, white target dot. Participants were instructed to depress the space bar on the computer keyboard at the instant that the green dot reached the white target dot. The speeds in the present study were chosen based on the speeds of stimulus movement with the Bassin Anticipation Timer Brady (1996) used. Stimulus speeds in Brady's (1996) investigation were 6, 9, 12, and 15 mph. The speeds for the present study were scaled so that the moving target moved at a velocity proportional to the total length of the target path. In this study, the on-screen distance between the start and end position for the moving target was 272 millimeters. The path length represents a 13-fold decrease in target path length compared to the Brady (1996) investigation.

Qualitative feedback was given to participants between each trial. If the CAT error ranged from  $\pm 1$  to  $\pm 100$  milliseconds, feedback consisted of a message reading "too early" or "too late". If CAT error exceeded  $\pm 100$  milliseconds, feedback consisted of a message indicating that the participant was "much too early" or "much too late" (Wrisberg et al., 1979). CAT error was recorded in the amount and direction in milliseconds for each trial. During participation, participants only received qualitative feedback on the computer screen. Once all trials were completed, the participant was able to see only their results if they desired. Results

were only the amount and direction of milliseconds they were too early or too late. No feedback was given to the participant comparing their results to the results of other participants.

### *Procedure*

This study included one session of data collection for each participant. Upon arrival for the test session, participants received a verbal description of the testing, at which point they read and signed an IRB-approved informed consent document. Participants were then asked to complete a short questionnaire regarding their athletic history. Once the questionnaire was complete, participants were seated at a computer station and instructed to depress a button when the green CAT dot on the left side of the computer monitor reached the white target dot on the right side of the monitor. Each participant performed a series of familiarization trials, which consisted of five trials at each of the four different speeds. Then, each participant completed a total of 16 trials (four trials for each of the four speed conditions). To control for contextual bias, differing speed trials were presented in a counterbalanced manner (Haywood, Greenwald, & Lewis, 1981). A fixed foreperiod of two seconds was presented between each trial.

### **Results**

Brady (1996) used three dependent measures derived from the raw data to examine CAT. Therefore, this study used the same measures, which included absolute error, constant error, and variable error. Absolute error was the magnitude of error, constant error indicated directional biases as to whether participant's responses were early or late, and variable error represented the consistency about participants' mean constant error. The dependent measures were analyzed using a three-way factorial multiple analysis of variance design. Bonferroni correction was used during *post hoc* tests to determine significance levels. The alpha level was set at the .05 level.

*Absolute Error*

The means and standard deviations for absolute error are presented in Table 1. A significant main effect for sex was present. Results showed that men (M=25.29 msec.) were more accurate than women (M=31.48 msec.). Sex accounted for 19% of the variance in absolute error scores. Experience also had a significant main effect on absolute error. *Post hoc* analysis indicated that open skills athletes (M=26.15 msec.) performed with less error than non-athletes (M=30.63 msec.). Experience accounted for 10.9% of the variance in absolute error scores.

Table 1  
Means and Standard Deviations for Absolute Error (Rounded to Nearest Millisecond)

Classification Sex		Speeds							
		6 mph		9 mph		12 mph		15 mph	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Open	Men	19	4	27	7	25	6	26	7
Open	Women	22	7	28	7	31	10	32	8
Control	Men	20	4	20	3	34	10	33	8
Control	Women	27	3	35	9	40	3	37	12

The main effect for speed was significant, as well. *Post hoc* tests indicated that overall participants were the most accurate at 0.46 mph (M=22.04 msec.), while they performed the least accurate at 0.92 mph (M=32.38 msec.). Sex and speed interacted; however, follow-up tests did not reach significance. Investigation of means showed that women were the least accurate at the 0.92 mph speed compared to the other speeds. Results also showed that men performed with the most accuracy at 0.46 mph. Experience and speed interacted, but once again follow-up tests did not reach significance. Inspection of means demonstrated that open skills athletes performed better at slower (0.46 mph and 0.69 mph) speeds compared to faster speeds. An interaction between sex and experience occurred, although further tests determined the interaction was not at a statistically significant level. Men open skills athletes performed the most accurate, while non-athletic women performed the least accurate. A three-way interaction (Figure 1) between sex,



experience, and speed occurred, but follow-up tests did not reach significance. Upon inspection, it appears men open skills athletes performed with the least amount of absolute error at the slowest speed.

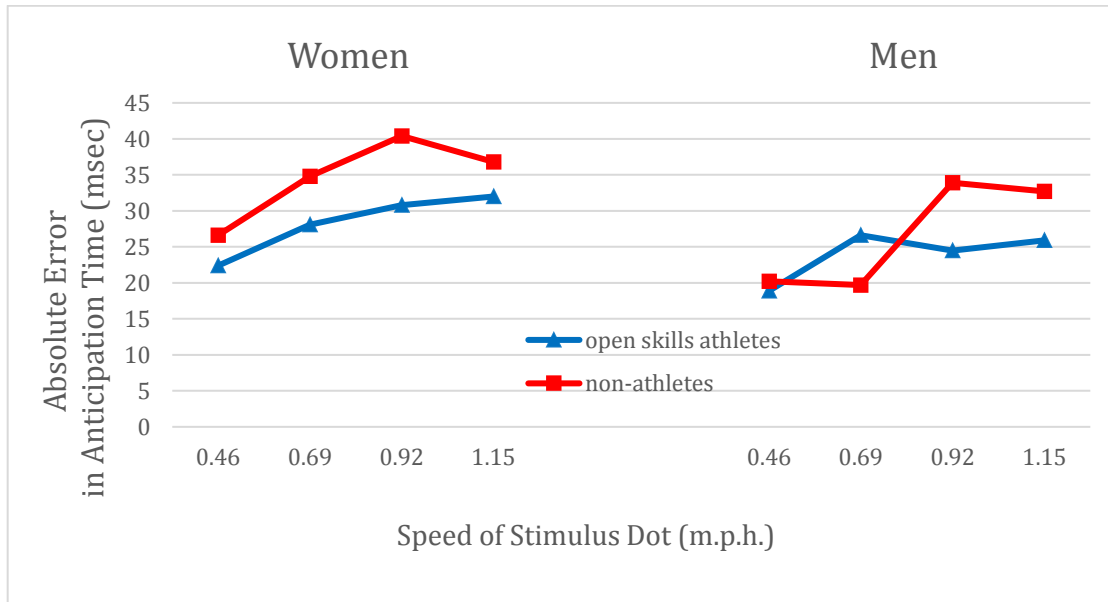


Figure 1. Absolute error as a function of sex, experience, and speed.

*Constant Error*

The means and standard deviations for constant error are listed in Table 2. A significant main effect was present for sex. Men ( $M = -2.17$  msec.) reacted with less directional bias than women ( $M = 3.88$  msec.). Sex accounted for 6.6% of the variance in constant error scores. A main effect for experience was also significant. *Post hoc* analysis indicated that open skills athletes ( $M = -2.21$  msec.) had early responses, whereas non-athletes ( $M = 3.92$  msec.) had late responses. Experience accounted for 6.8% of the variance in constant error scores. A significant main effect was present for speed. *Post hoc* analysis showed that participants were the earliest at the 0.92 mph speed ( $M = -3.55$  msec.). Participants reacted the latest at 1.15 mph ( $M = 4.57$  msec.). An interaction between sex and speed occurred, however, follow tests did not reach significance.

Table 2  
Means and Standard Deviations for Constant Error (Rounded to Nearest Millisecond)

Classification Sex		Speeds							
		6 mph		9 mph		12 mph		15 mph	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Open	Men	-3	4	-3	11	-1	9	-1	5
Open	Women	-2	17	4	8	-13	9	1	21
Control	Men	6	6	-2	4	-7	17	-5	22
Control	Women	1	7	10	11	8	11	23	18

Men tended to respond the earliest at 0.92 mph, while they tended to respond the latest at the slowest speed. Similar to the men, the women responded the earliest at 0.92 mph. However, women reacted the latest at the fastest speed. Experience and speed interacted as well, with results showing non-athletes responding the latest at the fastest (1.15 mph) speed, while open skills athletes responded the latest at the 0.69 mph speed. A significant interaction between sex and experience occurred. Men open skills athletes performed with the least amount of directional bias, while non-athletic women performed with the most bias. A three-way interaction (Figure 2) between sex, experience, and speed occurred. Non-athletic men responded the earliest at the 0.92 mph speed, while responding the latest at 0.46 mph. Non-athletic women had the most bias at the 1.15 mph speed. Open skills athletic men responded earliest at 0.69 mph, while open skills athletic women responded earliest at 0.92 mph.

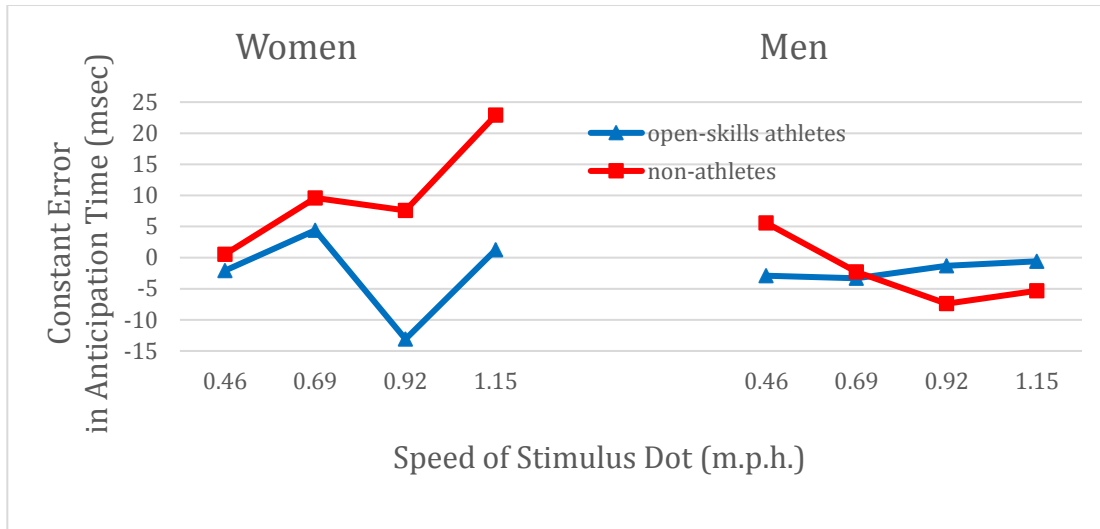


Figure 2. Constant error as a function of sex, experience, and speed.

*Variable Error*

The means and standard deviations are presented in Table 3. Experience had a significant main effect on variable error. *Post hoc* analysis indicated that open skills athletes (M=31.57 msec.) were more consistent than non-athletes (M=36.59 msec.). Experience accounted for 10.1% of the variance in variable error scores. A significant main effect for sex occurred on variable error. *Post hoc* analysis showed that men (M=31.65 msec.) performed with less

Table 3  
Means and Standard Deviations for Variable Error (Rounded to Nearest Millisecond)

Classification Sex		Speeds							
		6 mph		9 mph		12 mph		15 mph	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Open	Men	25	4	32	7	31	9	34	8
Open	Women	25	7	35	10	37	13	34	9
Control	Men	24	4	26	1	44	9	38	12
Control	Women	33	4	41	10	49	2	39	12

variability than women (M=36.51 msec.). Sex accounted for a total of 9.6% of the variance in variable error. Speed had a significant main effect on variable error, as well. *Post hoc* analysis indicated that participants were the most variable at the 0.92 mph speed (M=40.24 msec.), while

being the least variable at the 0.46 mph speed (M=26.68 msec.). An interaction between sex and speed occurred, however not at a statistically significant level. Both men and women performed with the least amount of consistency at 0.92 mph, while they were the most consistent at 0.46 mph. Experience and speed also had an interaction, but it was not significant. Open skills athletes and non-athletes were most variable at 0.92 mph, while being the least variable at 0.46 mph. A non-significant interaction between sex and experience occurred. Men open skills athletes performed with the most consistency. However, non-athletic women performed with the least amount of consistency. A three-way interaction (Figure 3) between sex, experience, and speed occurred. Results were not significant. Non-athletic women performed with the most variability at 0.69 mph compared to all other groups. Non-athletic men were the least variable across the board at 0.46 mph compared to all other groups.

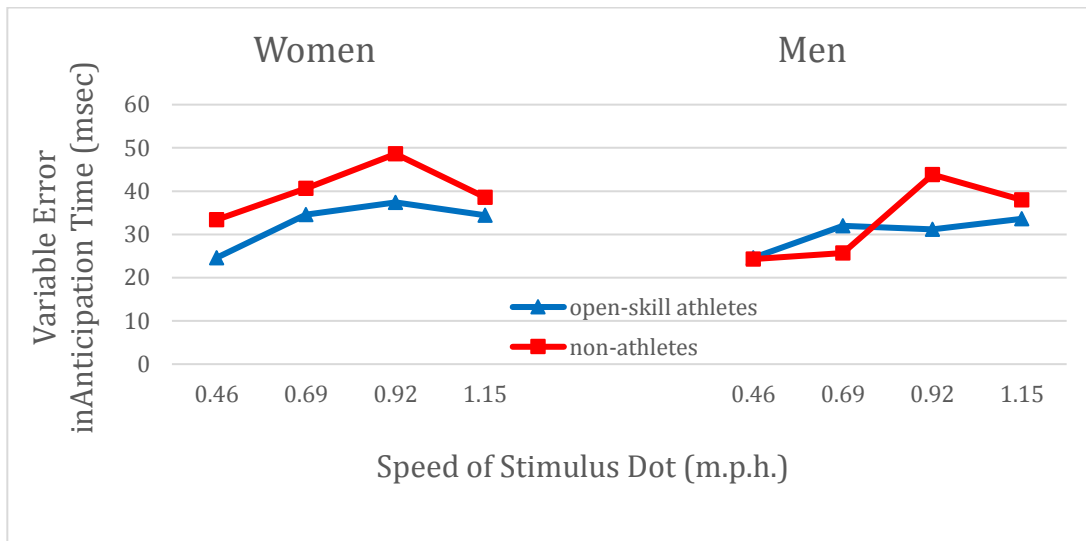


Figure 3. Variable error as a function of sex, experience, and speed.

### Discussion

In this investigation, support was found for differences in CAT between open skills athletes and non-athletes. Absolute error variance was 11% in both this study and Brady’s (1996) investigation. Open skill athletes performed more accurate than non-athletes. Variable error

variance was 10% in this investigation and 15% in Brady's (1996) study. Results from both studies presented with open skills athletes performing more consistently (less variable) compared to non-athletes. Findings from this investigation are in agreement with Del Rey et al., (1987) who also found that non-athletes responded with more error and more variability than participants with open skills athletic experience.

No significant sex differences within the experience categories were found. However, absolute error, constant error, and variable error did produce some differences for sex. In this study, sex accounted for 19% of the variance in absolute error scores, while Brady (1996) only found sex accounting for 8% of the variance. This study found men who compete in open skills sports are the most accurate, while non-athletic women are the least accurate. Del Rey et al., (1982) stated their results were indicative of experienced athletes performing with less absolute error compared to those who did not have open skills athletic experience. Overall, men proved to be more accurate during CAT tasks than women. Results from this investigation are in accordance with Wrisberg et al., (1979), Schiff & Oldak (1990), Blundell (1982). Each of those studies found men to be superior to women during timing of anticipation tasks. In contrast, Dunham & Reeve (1990) found no significant sex differences for absolute error. Also, Diggles-Buckles & Bassin (1990) found no main effects for sex in their investigation.

This investigation found a significant interaction between sex and experience for constant error, meaning only constant error is dependent upon sex and experience. Men open skills athletes performed the least about of directional bias, where as non-athletic women performed the most bias. Basically, men resulted in having less directional bias than women, which Brady (1996) also found. However, Diggles-Buckles & Bassin (1990) did not observe any main effects for constant error in their investigation.

Significant interactions between sex and experience on variable error were not found in this investigation. Although, results indicated men open skills athletes performed the most constant CAT tasks, while non-athletic women performed with the least amount of consistency. Overall, men performed with less variability compared to women. Del Rey et al., (1982), Wrisberg et al., (1979), and Diggles-Buckles & Bassin (1990) all had findings suggesting men performed more consistently than women. In this investigation, participants seemed the most variable at 0.92 mph and the least variable at 0.46 mph.

Limitations of this study include the small sample size of eighteen participants. Also, the novel software program had a green dot that moved across the screen in a linear trajectory, which can be a weakness of this investigation. Linear trajectory is not necessarily representative of real world tasks, especially in athletic events. Sports usually consist of objects moving in curvilinear paths, which can impact CAT.

Further research on CAT should include more investigations on real world tasks. Future assessments should also include an evaluation of the repeatability of the CAT software utility. Ultimately, the software-based CAT test may offer a more cost-effective and flexible assessment tool than traditional Bassin Timer devices.

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Appendix A Human Subjects Review Board Main Document

?? QUESTIONS ??  
 309A University Hall  
 (419) 372-7716  
 hsrb@bgsu.edu

?? QUESTIONS ??  
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**HUMAN SUBJECTS REVIEW BOARD**

Application for Approval of Research Involving Human Subjects

- Complete electronically and use the most current form.
- Applications judged to be incomplete or vague will be returned to the Principal Investigator for revision.
- Submission lead times - For Exempt Review projects – submit at least 2 weeks before your planned start date. For Expedited Review projects – submit at least 6 weeks before your planned start of recruiting and data collection. For Full Board projects – submit at least 2 months before your planned start of recruiting and data collection.

**I. Type of Review Being Requested:** (Select only **one** of the following options: Exempt, Expedited, Full Board)

**Exempt Review** (If exempt, select the most appropriate category below. [Click here](#) for more information.)

- Exempt 1:** Research in an educational setting, involving normal educational practices.
- Exempt 2:** Tests, surveys, interviews, or observation when information is recorded anonymously or there is no risk (criminal, civil, financial, reputation, etc.) to subjects. Subjects must be adults.
- Exempt 3:** Tests, surveys, interviews, or observation of public officials or candidates, or when Federal statues requires confidentiality.
- Exempt 4:** Use of existing data if the sources are publically available or if data are recorded anonymously by the investigator.
- Exempt 5:** Projects requiring approval of Agency heads and evaluate aspects of public services programs.
- Exempt 6:** Food quality evaluation and consumer acceptance studies.

**Expedited Review** (If expedited, select the most appropriate category below. [Click here](#) for more information.)

- Expedited 1:** Clinical studies of drugs or medical devices when special conditions are met.
- Expedited 2:** Only collection of blood. Amount and frequency is specified in regulations.

- Expedited 3: Noninvasive means of collecting biological specimens.
- Expedited 4:** Noninvasive means of data collection routinely employed in clinical practice (e.g., moderate exercise, physical sensors applied to body, body composition assessment, etc.).
- Expedited 5:** Use of existing data that were collected for non-research purposes (e.g., medical treatment). Some research in this category may be exempt under Exempt 4.
- Expedited 6: Collection of data from voice, video, image recordings made for research purposes.
- Expedited 7:** Research using surveys, interviews, focus groups, program evaluation, communication, etc. Some research in this category may be exempt under Exempt 2.

**Full Board Review**

- Full Board:** Research that does not fall into the above categories, is more than minimal risk to subjects, or is indicated as requiring Full Board in sections IV and VI of the application below.

**II. General Information:**

- a. Name of applicant (Principal Investigator): Mallory Fritz
- b. Title of the Proposed Research Project: Validation of Novel Software Program to Assess Coincidence Anticipation Timing
- c. Have you requested, or do you plan to request, external support for this project?  Yes  No  
If yes, external Funding Agency or Source:

d. The Principal Investigator is (check one):

- Faculty       BGSU Staff       Undergraduate Student       Graduate Student

Off-campus applicant (check this box if you are not affiliated with BGSU but propose to conduct research involving BGSU Faculty, Staff, or Students)

Department or Division: Kinesiology

Campus Phone:

E-mail: fritzmj@bgsu.edu

Have You Completed the required BGSU Human Subjects Training?

- Yes (Office of Research Compliance will confirm training date.)
- No (This application will not be reviewed. See HSRB website for training information.)

e. If applicable, list the names of key personnel\* associated with the project: \_\_\_\_\_

\*Key Personnel are defined as research personnel who are directly involved in conducting research with human subjects through an interaction or intervention for research purposes, OR who are directly involved with the recording or processing identifiable private information, including protected health information, related to those subjects for the purpose of conducting a research study. Student PIs should only list their project advisor in item II.b below.

Have Key Personnel Completed the required BGSU Human Subjects Training?

- Yes (Office of Research Compliance will confirm training date.)  
 No (This application will not be reviewed. See HSRB website for training

information.)

f. If you are a BGSU student, please provide the following information:

This research is for:  Thesis  Dissertation  Class Project  Other

Advisor's Name (This is the advisor for this research project): Adam Fullenkamp, Ph.D.

Department or Division: Kinesiology Phone: 372-6929 E-mail: fullena@bgsu.edu

Has Advisor Completed the required BGSU Human Subjects Training?

- Yes (Office of Research Compliance will confirm training date.)  
 No (This application will not be reviewed. See HSRB website for training

information.)

### III. Information on Projects Using Pre-existing Data

**(Skip to Section III if this project does NOT use pre-existing data. Pre-existing data includes retrospective medical chart reviews, public data sets, etc. Sometimes it is referred to as secondary data or archival data.) Some projects involving the use of pre-existing data may not require review by the HSRB. However – it is the HSRB's responsibility to make that determination – not the researcher's.**

**NOTE: If you are obtaining medically-related information from a "Covered Entity" (a health plan, health care clearinghouse or a health care provider who bills health insurers – e.g., hospitals, doctor's offices, dentists, the BGSU Student Health Service, the BGSU Speech and Hearing Clinic, the BGSU Psychological Services Center), the HIPAA Privacy Rule may apply.**

a. Name(s) of existing data set(s) [Include any ancillary data sets you might be linking the main data set(s) to]:

**b.** Source(s) of existing data set(s):

**c.** Please provide a brief description of the content of the data set(s):

**d.** When you **obtain** the data, will the individual records be anonymous or will they have identifiers/codes attached?

Anonymous (*i.e., no identifiers or codes attached to any records in any of the listed data sets*)

*(If you indicated “anonymous” and your project also involves direct data collection, please go to section IV and complete the rest of the application. Otherwise, please go to and complete sections V, VIII.a, VIII.b, and IX.)*

Identifiers/codes attached (*examples would include, but not be limited to, record numbers, subject numbers, case numbers, etc.*)

**d.1** If the records have identifiers or codes attached, can you readily ascertain the identity of individuals to whom the data pertain (*e.g., through use of a key that links identifiers with identities; linking to other files that allow individual identities to be discerned*)?

Yes, I can ascertain the identity of the individuals.

Please explain in the box below how you will protect the confidentiality of subjects. The Human Subjects Review Board is concerned about 2 dimensions of confidentiality: (1) that the researcher has legitimate access to the records, i.e., the records are not protected by any special confidentiality conditions, and (2) that the researcher will not reveal individual identities unless permission has been granted to do so.

No, I cannot readily ascertain the identity of the individuals.

Please describe in the box below, the provisions in place that will not allow you to ascertain identities (*e.g., key to decipher the code/identifier has been destroyed, agreement between researcher and key holder prohibiting the release of the key*).

(If you answered “no” and your project also involves direct data collection, please go to section IV and complete the rest of the application. Otherwise, please go to and complete sections V, VIIIa, VIIIb, and X.)

- e. Are the data from a public data set? (A public data set is data available to any member of the public through a library, public archive or the Freedom of Information Act. Data obtained from private companies, hospital records, agency membership lists or similar sources are not usually public data)

Yes

Are you requesting permission to conduct multiple research projects with these data?

Yes  No

(If you answered “Yes” and your project also involves direct data collection, please go to section IV and complete the rest of the application. Otherwise, go to and complete sections V, VIII.a, VIII.b and X.)

No (if no, please answer the following questions)

- f. If you are obtaining access to non-public information, please explain in the box below how you will obtain access to the information (e.g., permission from the CEO, permission from the Board of Education). Note: a condition for approval will be written documentation of this permission – this can be an email from the relevant authority.

- g. Before the data were collected, did respondents give their permission for the information to be used for research purposes?  Yes  No

- h. Are you **recording** the data in a manner that will allow you to identify subjects, either directly or through identifiers linked to the subjects?

Yes  No

- i. If your project also involves direct data collection, please continue completing the rest of the application. Otherwise, go to and complete V, VIII.a, VIII.b, and X.

**IV. General Project Characteristics:** Does the research involve any of the following? (If the response to any of the following is “yes,” provide a justification and/or rationale in the box provided below)

Yes  No

a. Deception of subjects  
(if “yes,” this application will go to the full Board for review).

Yes  No

b. Shock or other forms of punishment  
(if “yes”, this application will go to the full Board for review).

- c. Sexually explicit materials or questions
- d. Handling of money or other valuable commodities
- e. Extraction of blood or other bodily fluids
- f. Questions about drug and/or alcohol use
- g. Questions about sexual orientation, sexual experience, or sexual abuse
- h. Purposeful creation of anxiety
- i. Any procedure that might be viewed as an invasion of privacy
- j. Physical exercise or stress
- k. Administration of substances (food, drugs, etc.) to subjects
- l. Any procedure that might place subjects at risk (e.g., disclosure of criminal activity).
- m. Systematic selection or exclusion of any group. This includes the selection or exclusion of any group based on age, gender, race, ethnicity, etc.

The target age for this research is 18-30 years old. Equal numbers of males and females will be a target, as well.

**V. HIPAA:** If you answer “Yes” to any of the following questions, your project is subject to HIPAA and you must complete the HIPAA Supplement (available online at [www.irbnet.org](http://www.irbnet.org) in the forms and templates tab).

- |                                 |   |   |
|---------------------------------|---|---|
| Yes<br><input type="checkbox"/> | No<br><input checked="" type="checkbox"/> | <b>a.</b> Will health information ( <i>information relating to the past, present, or future physical or mental health or condition of an individual</i> ) be obtained from a covered entity ( <i>a health plan, health care clearinghouse or a health care provider who bills health insurers – e.g., hospitals, doctor’s offices, dentists, the BGSU Student Health Service, the BGSU Speech and Hearing Clinic, the BGSU Psychological Services Center</i> )? |
| <input type="checkbox"/>        | <input checked="" type="checkbox"/>       | <b>b.</b> Will the study involve the provision of health care in a covered entity?  |
|                                 | Yes<br><input type="checkbox"/>           | No<br><input type="checkbox"/>  |
|                                 |   | <b>b.2</b> ( <i>Complete this only if you answered “Yes” to IV.b – otherwise, skip this item</i> ). If the study involves the provision of health care, will a health insurer or billing agency be contacted for billing or eligibility?  |

**VI. Subject Information:** (If the response to any of the following is "yes," the researcher should be sure to address any special needs of the potential subjects in the informed consent process. For example, if subjects are over the age of 65, then it may be appropriate to use a larger font in all correspondence with subjects to ensure readability.)

- |                                 |   |   |
|---------------------------------|---|---|
| Yes<br><input type="checkbox"/> | No<br><input checked="" type="checkbox"/> | <b>Does the research involve subjects from any of the following categories?</b> |
|                                 |   | <b>a.</b> Under 18 years of age included in the target population               |



(If “yes” signed, active parental consent is required for those individuals who are under 18 unless a waiver is granted by the HSRB. If you are requesting a waiver of parental consent, this application will go to the full Board for review.)

- b. Over 65 years of age as the target population
- c. Persons with a physical or mental disability as the target population (If “yes” this application will go to the full Board for review.)
- d. Economically or educationally disadvantaged as the target population.
- e. Unable to provide their own legal informed consent (If “yes” and the subjects are not children, this application will go to the full Board for review).
- f. Pregnant females as the target population (If “yes” this application will go to the full Board for review).
- g. Victims of crimes or other traumatic experiences as the target population
- h. Individuals in institutions (e.g., prisons, nursing homes, halfway houses) (If “yes” this application will go to the full Board for review).

**VII. Risks and Benefits:** (Note: the HSRB retains final authority for determining risk status of a project)

- | Yes                      | No                                  | Please answer the following questions about the research.  |
|--------------------------|-------------------------------------|--|
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | a. In your opinion, does the research involve more than minimal risk to subjects? ("Minimal risk" means that "the risks of harm anticipated in the proposed research are not greater, considering probability and magnitude, than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.") If the answer is "yes," explain in the box below and provide an explanation of the <b>benefits</b> of the research to the subjects and to society.) |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | b. Are any <b>emergencies or adverse reactions</b> (physical, psychological, social, legal, or emotional) probable as a result of the research? (If "yes," then explain the measures to be taken in case of emergency in the box below.)   |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | c. Will participation in this research result in any appreciable negative change in the subject’s emotional state? (If “yes,” explain the nature of the change and the process for assisting subjects in the box provided.)  |

**VIII. Project Description:** (Please provide as much information as you feel will adequately answer the following questions.)

- a. What are you going to study? What is (are) the research question(s) to be answered / hypotheses to be tested?

We propose to examine the coincidence anticipation timing differences between open-skill athletes, closed-skill athletes, and non-athletes. We will also assess the results to determine if any sex differences are apparent within the classification groups. The third purpose of the research is to validate a new novel software program we develop. Coincidence anticipation timing is the ability of an individual to judge the trajectory of a moving stimulus and to organize a motor response so that the arrival at the target coincides with the arrival of the moving object at the same time. Open-skill athletes are those who participate in sports such as basketball, soccer, lacrosse, or tennis. However, closed-skill athletes are those who participate in swimming or track. Non-athletes will be individuals who participate in any organized sport or physical recreation less than one hour per week.

- b. Discuss the benefit(s) of this study. Why is this study important? (provide scholarly support) Include a discussion of benefits to individual participants as well as to society as a whole. **NOTE: Compensation or incentives (e.g., gift cards, research credit, extra credit, etc.) offered for participation are not considered to be benefits.**

Coincidence anticipation timing tasks occur in everyday life, ranging from shaking hands with another person, to picking up a cup from a table, to catching a ball. On a daily basis, humans react to various moving objects, which then produce catching, dodging, and interception responses (Fleury & Bard, 1985). Coincidence anticipation timing is also present in sports. Being able to catch a football or baseball, return a tennis serve, hit a baseball or softball, or kick a soccer ball are all important tasks in sport that require correct judgement of when a ball will arrive at a location in order to complete the task. Conducting research on coincidence anticipation timing with a new novel software program can potentially give researchers a new way to measure the anticipation timing. Brady (1996) suggested that future studies test coincidence anticipation timing in more complex ways than using a Bassin Anticipation Timer. This replication study can be beneficial, because we can learn if the new computer software program will be useful in future studies measuring coincidence anticipation timing.

- c. Are there any risks associated with this study? If so, explain how you will minimize the risks to subjects.

Due to the participants sitting at a computer for approximately 20 minutes and depressing a computer key, the investigators believe that there is minimal risk associated with this research.

- d. Who will be your subjects?

Approximately 20 student athletes and 10 student non-athletes (15 male and 15 female) from the BGSU Campus Community between the ages of 18 and 30 will be

recruited to participate in this study.

- e. List the maximum number of subjects you hope to enroll.  
*(Recruiting is not enrollment – you will likely recruit more individuals than will be enrolled in the project. Also, factor in the possibility of withdrawals, which may require enrolling of additional subjects in order to achieve your desired sample size. If, during the course of the project, you need to increase the number of subjects to be enrolled, you must request Board approval for the increase.)*

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- f. How will you recruit your subjects? Please describe the method(s) you will use to recruit (examples include via telephone, mailings, sign-up sheets, etc.). Please include recruitment letters, scripts, sign-up sheets as appropriate with the application.

We plan to post signage around the Eppler Building and BGSU Campus Community. A sample flier is attached to this submission.

- g. Describe the process you will use to seek informed consent from the subjects (Example – provide consent document to potential participants, allow them to read over the information, ask them if they have any questions, answer questions to their satisfaction, then request them to sign the consent document).  
*(See IRBNet library for consent document skeleton.)*

Prior to each individual's participation in the study, they will be given a verbal explanation of the study and then they will be asked to read and sign an approved informed consent document after all of their questions have been answered.

- |                                     |                          |   |
|-------------------------------------|--------------------------|---|
| <b>Yes</b>                          | <b>No</b>                |   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <b>g.1.</b> Are you seeking consent/assent from all relevant parties?<br>(If "No", explain why not in the box provided below) |

- |                                     |                          |   |
|-------------------------------------|--------------------------|---|
| <b>Yes</b>                          | <b>No</b>                |   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <b>g.2.</b> Are you having your participants <b><u>physically sign hard copies</u></b> of consent/assent form(s)? |

If "No," you are requesting a waiver of written consent. Please select one of the justifications below.

- That the only record linking the subject and the research would be the consent document and the principal risk would be potential harm resulting from a breach of confidentiality.
- That the research presents no more than minimal risk of harm to subjects and involves no procedures for which

written consent is normally required outside of the research context.

Please indicate how you will document consent in the box below.  
 (For example, in an electronic survey, clicking the next button indicates consent to participate.)

- h. If deception or emotional or physical stress is involved, subjects must be debriefed about the purposes, consequences, and benefits of the research and given information on procedures they can follow or resources that are available to them to help them handle the stress. Please include a copy of all debriefing materials, if applicable.

Debriefing form:  Yes  No

- i. Explain in the box below the procedures you will follow to protect the confidentiality of your subjects. Include considerations associated with data and/or consent form collection and storage, and dissemination of results. Explain whether or not the study is anonymous. *(Note: It is not always necessary to protect the confidentiality of your subjects, but they must be informed if you plan to quote them directly or reveal their identities in any way.)*

Subjects will be assigned a number and will be referred to by that number for the remainder of this experiment. For example, John Doe will be known as participant #1, Jane Doe will be known as participant #2, etc. The form containing the name and number information will be kept in a locked file cabinet in the Biomechanics/Motor Behavior lab, to which access is limited to key holders. Once the experiment is complete, the form will be destroyed. Data analysis will be kept on a password protected computer, which is also located in the Biomechanics/Motor Behavior lab.

- j. Describe what subjects will be asked to do or have done to them from the time they are first contacted about the study until their participation in the study ends. Note – a summary of this information should be included in information provided to the subjects as part of the consent process.

During the data collection period, participants will be asked to complete two separate testing sessions, each lasting approximately 20-30 minutes in duration. The first testing session conducted will include acquiring all preliminary data related to the informed consent document, as well as required demographic and athletic background data. Prior to beginning the data collection trials, the participants will go through a familiarization trial due to the anticipation that none of the recruited participants will have experience with the software program measuring coincidence anticipation timing. Participants will be provided with an approved informed consent document to review and sign during the first test session. Once all questions and clarifications have been addressed by the researchers, and the participants have signed the informed consent document, the remainder of the first session data will be collected, including participants completing a brief demographic and athletic history survey.

Once the survey has been completed, participants will be seated in front of a computer monitor for the familiarization phase of testing. The participants will be instructed to depress a button when a specific mark on the screen lines up with a pre-

determined target. During data collection, the mark will move at one of four set speeds for each of the 16 trials. The familiarization phase will include up to five trials at each speed, prior to completing the test trials. A trial testing each speed will be presented an equal number of times and, to control for contextual bias, differing speed trials will be presented in a counterbalanced manner. A fixed foreperiod of two seconds will be present between each trial. Qualitative feedback will be given to participants after each trial. If the coincident anticipation timing error ranges from  $\pm 1$  to  $\pm 100$  milliseconds, feedback will consist of the a message of “too early” or “too late”. If coincident anticipation timing error exceeds  $\pm 100$  milliseconds, feedback will consist of a message indicating that the participant was “much too early” or “much too late”. Coincident anticipation timing error will be recorded in the amount and direction in milliseconds for each trial. Once all 16 trials have been completed for each cursor speed, the first testing session will be concluded.

The second test session will be identical to the first test session of actual data collection. The participants will arrive and be seated in front of the computer monitor. Participants will again have 16 trials of testing with each of the four speeds presented an equal number of times in a counterbalanced manner. A fixed foreperiod of two seconds will still be present between each trial. Qualitative feedback will again be given to participants after each trial. Error will still be recorded as well. Once all 16 trials have been completed, the second testing session will be complete.

**IX. Consent Form Checklist:** If you are using an informed consent document, you must use the checklist below to check off the required information. Need help with your consent document? Click [here](#) for the consent document skeleton.

- The consent document is on BGSU or departmental letterhead.
- Stated the purpose of the study.
- Stated the benefits of this project (to your field of study and to participants).
- Stated the risks of participation. If there are none, you can indicate that the “risk of participation is no greater than that experienced in daily life”.
- An explain for how confidentiality will be protected has been provided. For example: Where will the data will be stored, and who will have access to the data?
- Indicated that participation in the study is voluntary.
- Indicated that participants are free to withdraw at any time.
- Indicated how much time participation will take.
- Informed participants that deciding to participate or not will not impact any relationship they may have with BGSU.
- Provided the contact information for the PI (phone and email) regarding questions about the study.
- If the PI is a student, provided the contact information for the Advisor (phone and email) regarding questions about the study.
- Provided the contact information for the HSRB (419-372-7716 and hsrb@bgsu.edu) regarding questions about participant rights.
- “Anonymous” or “Confidential” are used correctly.
- Consent/Assent document is at an appropriate reading level. You can use the Flesch/Kincaid test in Microsoft Word to test the reading level.
- If there is any chance that participants could be under 18, indicated that participants must be at least 18 years old to participate in the study.

- Changed all “I understand” phrases to “I have been informed”.
- Statements about accidental injury and unforeseen risk have been removed.
- Acronyms have been spelled out.
- If the study is online, informed participants to clear their internet browser and page history.
- If requesting a waiver of written consent, indicated how consent will be documented. For example, “Completing and returning the survey indicates consent to participate.”

**X. By electronically signing this application package in IRBNet, I certify that:**

1. The information provided in this application is accurate and complete.
2. I have the ultimate responsibility for the protection of the rights and welfare of human subjects and adherence to any study-specific requirements imposed by the HSRB.
3. I will comply with all HSRB and BGSU policies and procedures, as well as with all applicable Federal, State and local laws and regulations regarding the protection of human subjects in research.
4. I agree to the following:
  - I accept responsibility for the scientific and ethical conduct of this research study
  - I will obtain HSRB approval before amending or altering the research protocol or implementing changes in the approved consent documents or recruitment procedures
  - I will immediately report to the HSRB any serious adverse events and/or unanticipated effects on subjects which may occur as a result of this study
  - I will train study personnel in the proper conduct of human subjects research
  - I will complete and return the Continuing Review form when requested to do so by the HSRB

## Appendix B Human Subjects Review Board Approval Letter



DATE: May 19, 2016

TO: Mallory Fritz

FROM: Bowling Green State University Human Subjects Review Board

PROJECT TITLE: [905609-2] Validation of Novel Software Program to Assess Coincidence Anticipation Timing

SUBMISSION TYPE: Revision

ACTION: DETERMINATION OF EXEMPT STATUS

DECISION DATE: May 19, 2016

REVIEW CATEGORY: Exemption category # 2

Thank you for your submission of Revision materials for this project. The Bowling Green State University Human Subjects Review Board has determined this project is exempt from IRB review according to federal regulations AND that the proposed research has met the principles outlined in the Belmont Report. You may now begin the research activities.

Comment: Note that only members of the research team can have access to the signed consent documents and study data. If people other than members of the research team have access to the locked file cabinet and password protected computer they must either be added to the protocol or you must find another location for the documents and data.

Note that an amendment may not be made to exempt research because of the possibility that proposed changes may change the research in such a way that it is no longer meets the criteria for exemption. A new application must be submitted and reviewed prior to modifying the research activity, unless the researcher believes that the change must be made to prevent harm to participants. In these cases, the Office of Research Compliance must be notified as soon as practicable.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact Kristin Hagemyer at 419-372-7716 or [khagemy@bgsu.edu](mailto:khagemy@bgsu.edu). Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Bowling Green State University Human Subjects Review Board's records.



## Appendix C Recruitment Flyer



# VOLUNTEERS NEEDED!

- The **BGSU Biomechanics and Motor Behavior Lab** is looking for men and women between the ages of 18 & 30 to participate in a reaction time study.
- Special Qualifications: Both non-athletes and competitive athletes from various sports are wanted.
- Participants will sit at a computer for approximately 20 minutes on each of two separate days and complete a reaction time task designed to test one's ability to anticipate the timing of a moving target.

## Interested? Questions?

Contact Ms. Mallory Fritz: [fritzmj@bgsu.edu](mailto:fritzmj@bgsu.edu) or  
Dr. Adam Fullenkamp: [fullena@bgsu.edu](mailto:fullena@bgsu.edu)

## Appendix D Email to Athletic Coaches

Hello Coach (Insert last name),

My name is Mallory Fritz and I am a graduate student in the School of Human Movement, Sport & Leisure Studies, specifically majoring in Kinesiology. For my Master's project I am conducting a reaction timing study using a newly developed computer software program. I am looking to recruit BGSU student-athletes between the ages of 18 and 30. I would like to recruit a variety of athletes, so I would only like to recruit one or two players from your team, if possible. Participating in my reaction timing study will consist of two different days of laboratory testing, but each session will last no more than 30 minutes.

If you are interested in participating in my study, please email me ([fritzmj@bgsu.edu](mailto:fritzmj@bgsu.edu)) for more information.

Thank you for your time,

Mallory Fritz

[fritzmj@bgsu.edu](mailto:fritzmj@bgsu.edu)

## Appendix E Informed Consent Document



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BOWLING GREEN STATE UNIVERSITY

**School of Human Movement, Sport, and Leisure Studies****Informed Consent** – Validation of novel software program to assess coincidence anticipation timing

Being between the ages of 18 and 30, and a student at Bowling Green State University, I agree to participate in this research study led by Ms. Mallory Fritz and Dr. Adam Fullenkamp in the School of Human Movement, Sport, & Leisure Studies, Bowling Green State University. Participants may contact Mallory Fritz, graduate student, School of Human Movement, Sport, & Leisure Studies, Bowling Green State University, 419-575-9175 ([fritzmj@bgsu.edu](mailto:fritzmj@bgsu.edu)) or Adam Fullenkamp, Ph.D., Assistant Professor, School of Human Movement, Sport, & Leisure Studies, Bowling Green State University, 419-372-6929 ([fullena@bgsu.edu](mailto:fullena@bgsu.edu)) with any questions regarding the study. The investigators have explained the following points to me:

- The purpose of this study is to find out if there are differences in reaction timing between open-skill athletes, closed-skill athletes, and non-athletes. The second purpose of this study is to examine if there are sex differences in reaction timing. Finally, the third purpose of this study is to test a new reaction timing software program, specially designed for this study.
- The study will take place over two separate visits to our lab, the first visit lasting about 30 minutes and the second visit lasting 15-20 minutes in the Eppler South Biomechanics/Motor Behavior laboratory on the BGSU campus. I will first be given a consent document to review and sign before testing. After all of my questions have been answered by the investigators, and I have signed the consent form, the study will begin.
- During the first visit, I will answer a short list of questions about my age and athletic history. Next, I will be seated in front of a computer monitor and asked to complete a practice trial so that I am able to become familiar with the test. Once the practice trial is complete I will complete the reaction timing test. The reaction timing test will involve reacting to a target on the computer screen moving at four different speeds. Once the first day testing is complete, I will schedule my second testing visit with the investigators and the session will end.
- The second test session will take place between two days and one week of the first session.
- The second visit will be almost identical to the first. I will arrive in the lab and be seated at the same computer. I will then complete the same reaction timing test as the first visit. Once I have completed the test, my participation in the study will be concluded.
- I have been informed that my involvement is entirely voluntary and I may choose to stop at any time without any punishment. Choosing to be in this study or not be in this study will

have no effect on course grades or position in any class. I may ask questions at any point before, during, or after the study.

Risk of participation in this study is no greater than that experienced in daily life, since I will only be asked to sit at a computer and depress a button. Also, I have been informed that, while there are no direct benefits for myself for participating in this study, my data may help to develop cheaper and more flexible tools for testing human reaction time.

To protect confidentiality, hard copies of the informed consent and questionnaire documents will be kept in a locked file cabinet within the Biomechanics and Motor Behavior Lab, to which access is also limited to key holders.

Results of the study as a whole will be shared in a written paper, however data for each individual will be kept private by a password locked computer in the lab where only the investigators know the password.

I may contact the Chair, Human Subjects Review Board, Bowling Green State University, 419-372-7716 (hsrb@bgsu.edu), if problems or concerns come up during the study or if I have questions about my rights as a research participant.

\_\_\_\_\_  
Participant Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Participant Printed Name

*Please sign both copies & keep the one attached to the letter and return the separate one to the investigator.*

Eppler Complex      419-372-6905 (Phone)      Bowling Green, OH 43403-0249      419-372-2153 (Fax)

**BGSU HSRB - APPROVED FOR USE IRBNet ID # 905609  
EFFECTIVE 05/19/2016**

Appendix F Participant Questionnaire

Identification Number: \_\_\_\_\_ Date: \_\_\_\_\_

**Athletic History Questionnaire for Coincidence Anticipation Timing Study**

Age: \_\_\_\_\_ Biological Sex: \_\_\_\_\_

1. Please circle **all** NCAA sports, if any, you currently participate in at BGSU:

- |             |            |               |            |            |
|-------------|------------|---------------|------------|------------|
| Football    | Baseball   | Softball      | Basketball | Soccer     |
| Ice Hockey  | Volleyball | Cross Country | Golf       | Gymnastics |
| Swim & Dive | Tennis     | Track & Field |            |            |

Other: \_\_\_\_\_

2. How many years have you participated at the NCAA level for each sport circled above?  
(indicate "N/A" if not applicable)

\_\_\_\_\_  
\_\_\_\_\_

3. Please list all club sports within which you participate and the number of years that you have been active in each. (indicate "N/A" if not applicable)

\_\_\_\_\_  
\_\_\_\_\_

4. If you do **not** currently participate in any sport at the NCAA or club level, but have in the past, please list **all** sports you have participated in. Also, please indicate the last year in which you participated in each sport.

\_\_\_\_\_  
\_\_\_\_\_

5. From question 4, please list the number of years you participated in each sport in the past.

\_\_\_\_\_  
\_\_\_\_\_

6. If you have not participated in any sports at the NCAA or club level in the past 3 years, please list the average number of hours per week you participate in any type of organized sport or physical recreation.

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