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The Effects of observation, dialogue, and attentional focus in dyadic training protocol

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THE EFFECTS OF OBSERVATION, DIALOGUE, AND ATTENTIONAL FOCUS IN DYADIC TRAINING PROTOCOL

by

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ABSTRACT

The Effects of Observation, Dialogue, and Attentional Focus in Dyadic Training Protocol

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The present study examined the impact that dyad training with an emphasis on attentional focus has on learning in the performance of a golf putt. The participants were randomly divided into four dyad groups: dialogue and observation with external focus, dialogue and observation with internal focus, dialogue and no observation with external focus, and dialogue and no observation with internal focus. Participants were given a set of instructions to verbalize to their partners during practice. These instructions were designed to generate either an internal or an external focus. The results determined that those participants who were instructed to have an external focus performed better than those who did not. The results also showed that the dyad groups who observed their partners had no significant difference from those who did not, indicating that it is the dialogue and instructions given by each partner that has an effect on learning.

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CHAPTER 1

INTRODUCTION

In recent years, there have been several studies that have identified practice in dyads (that is, practice with partners of the same skill level) as an efficient and effective mode of training for a motor skill. Research previously done on dyad training shows evidence that the combination of being able to observe another learner and having verbal interaction with that learner during practice is not detrimental to learning, and in fact can enhance motor learning while allowing two participants to be trained at the same time (Shea, Wulf & Whitacre, 1999). In a recent study done by Granados and Wulf (2007), participants practiced a motor task (cup stacking) in dyads where certain groups were allowed observation only, and other groups were allowed dialogue only in order to determine which factor (observation or dialogue) of dyad training is responsible for improved learning of a given task. The results showed that those groups that included observation learned the task better than those who were not allowed to observe their partner during practice.

In another line of research, there have been several studies that have shown that the focus of attention of an individual learning a novel task plays a key role in how well that task is learned (see Wulf, 2007; Wulf & Prinz, 2001 for reviews). It has been demonstrated that an external focus of attention (directing performers' attention to the effects of their movements) has greater benefits than an internal focus of attention (directing attention to their own movements) when performing a motor skill (Wulf & Prinz, 2001). For example, Wulf, Höß, and Prinz (1998) had participants learn to balance

on a stabilometer platform. Whereas one group of participants was instructed to focus on keeping their feet horizontal (internal focus), a second group of participants was instructed to focus on keeping two markers horizontal that were attached to the stabilometer platform directly in front of their feet (external focus). Despite the subtle difference in instructions, the attentional focus induced by the researchers affected the learning of this task. The results revealed that the external focus condition yielded superior balance learning relative to the internal focus condition.

Given these findings, it would be interesting to recreate a dyad training study with a different task, and manipulate that task in such a way that the verbal interaction between partners emphasizes their focus of attention while performing it. In doing this, the outcome may yield opposite results from the "cup stacking" task, thus allowing the "dialogue" aspect of dyad training to play a larger role in the process of learning.

A golf putting task would require more instruction and learning of the appropriate technique than the cup stacking task did. The verbal cues on the position of the hands and feet as well as the swinging motion of the club will yield a greater need for dialogue between partners. In addition, since the dialogue between partners includes cues on focus of attention, the results of this study will allow for a greater understanding of the impact that dialogue has in dyad training. Thus, the purpose of this study is to determine if learning a golf putt is influenced by dyad training with external versus internal focus instructions and observation versus no observation of the partner during practice.

CHAPTER 2

LITERATURE REVIEW

Motor learning research, with its focus on discovering the laws and principles underlying the acquisition of motor skills, has had a large impact in the fields of coaching and teaching sports skills to novice learners. There are a number of different variables on motor skill learning that can be examined. In this study, the concentration will be on the effects of dyad practice and attentional focus in order to better understand how these factors may potentially interact to yield advantages in teaching a complex skill to a novice learner. In the following sections, an overview of research on dyad training and attentional focus as they relate to this study will be given.

Dyad Training in Motor Skill Learning

Practice in dyads has been shown to facilitate learning and increase training efficiency (i.e., training two participants at the same time). Shea, Wulf, and Whitacre (1999) examined dyad training and found results that suggest that one can combine the benefits of physical practice, observation, and dialogue between learners in an interactive way to produce an effective and efficient learning protocol. Their study was inspired by the work of Shebilske and colleagues (e.g., Shebilske, Regian, Arthur, & Jordan, 1992; see also Arthur, Day, Bennett, McNelly, & Jordan, 1997), who showed that having participants practice a video game ("Space Fortress") in dyads, such that each partner controlled half of the complex task (i.e., keyboard or joystick), was not detrimental to learning, compared to having participants practice the whole task individually. Thus, even though dyad practice did not enhance learning in that study, it was more efficient than individual practice as two people were trained in the same amount of time that it

would usually take to train one person. Another study by Arthur, Day, Bennett, McNelly, and Jordan (1997) showed that the reacquisition of the same task after an 8-week non-practice interval was similar for dyad and individual groups. Thus, again, while dyad training was not more effective, it was more efficient than individual practice.

Shea and colleagues (1999) followed up on these findings by using a modified dyad protocol. They argued that many tasks do not lend themselves to dual control as did the video game used by Shebilske and colleagues. Shea et al. (1999) used a dynamic balance task to compare the effectiveness of dyad versus individual practice. They found that participants who practiced with a partner learned the task more effectively and were subsequently superior to an individual practice group when tested one day later. Thus, in addition to being efficient, the dyad protocol resulted in enhanced learning.

Granados and Wulf (2007) took this one step further and separated the dialogue and observation that is existent in dyad training to examine the individual and interactive effects of each. They used a speed cup stacking task, and participants practiced under one of four conditions: observation/dialogue, observation/no dialogue, no observation/dialogue, and no observation/no dialogue. The results demonstrated that the practice conditions that included observation resulted in more effective learning than those that did not, while dialogue did not appear to have any effect. This suggested that the learning advantages of dyad practice were primarily due to the opportunity to observe another learner.

Reasons for the Advantages of Dyad Training

Several factors may be responsible for the beneficial effects of having performers practice in dyad groups. Besides the possible benefits gained from observing another

performer learning the task, practicing with another person in an interactive way might also aid in increasing the learners' motivation by adding competition to the practice situation (Lee & White, 1990). Namely, it may encourage learners to set goals at a higher level of difficulty than they normally would if they were performing by themselves. Setting goals, especially if they are specific and short-term (e.g., outperforming the partner) has been found to benefit the performance and learning of motor skills (Boyce, 1992; Kyllo & Landers, 1995; Weinberg, 1994).

Additionally, observational practice offers a form of practice in which the cognitive demands can be reduced. Since the observer is not physically performing the task, he or she can concentrate on its fundamental elements and develop or evaluate strategies that result in efficient and effective task performance. Also, many of the information-processing activities required by a task can be reviewed during the observation phase and not solely dedicated to the actual task execution (McNevin, Wulf & Carlson, 2000; Shea, Wright, Wulf & Whitacre, 2000).

Lastly, observing another learner allows performers to examine and avoid mistakes performed by their training partner. A study by Black and Wright (2000) tested this theory by having participants perform a series of key press tasks in which certain groups of participants had the opportunity to observe each other. They found that error recognition was in fact facilitated by observational practice.

Attentional Focus in Motor Skill Learning

Focus of attention has been shown to play an important role in the performance and learning of motor skills. Specifically, it is instructing a performer to focus on their own movements (internal focus) versus the effects of their movements (external focus)

that seems to have a substantial effect on learning (Wulf, 2007). In general, evidence has found that providing instructions and feedback that direct the learner to have an external focus of attention is more beneficial for learning than directing attention to the movements themselves (e.g., Shea & Wulf, 1999; Wulf, Höß & Prinz, 1998; Wulf & McNevin, 2003).

To assess performance and learning in previous studies of the effects of internal versus external foci of attention, investigators have used outcome measures that were mainly found in retention tests of a number of different tasks (Schmidt & Lee, 2005). Wulf et al. (1998, Experiment 2) used a dynamic balance task (a stabilometer) which requires participants to balance on a platform that tilts left and right. In this study, participants were instructed to either focus on their feet (internal focus) or on two markers on the platform of the stabilometer (external focus). A retention test showed that the external focus group did better. Similar studies have examined the generalizability of the learning advantages of an external focus of attention to the acquisition of sports skills. Wulf, Lauterbach, and Toole (1999) conducted a golf study, in which participants were directed to either focus on the swing of their arms (internal focus) or motion of the club head (external focus) while practicing a pitch shot. Here again, the external focus instructions greatly enhanced the accuracy of the shots in practice and in delayed retention. Wulf and Su (2007, Experiment 1) replicated this study with the inclusion of a control group (no attentional focus instructions). They found similar results as Wulf et al. (1999) – the external focus group had higher accuracy scores than the internal focus and control groups. External focus benefits have also been found for a tennis backhand and striking accuracy (Maddox, Wulf & Wright, 2000; Wulf, McNevin, Fuchs, Ritter &

Toole, 2000), volleyball serves (Wulf, McConnel, Gartner & Schwarz, 2002), soccer kicks (Wulf, Wachter & Wortmann, 2003) and basketball free throws (Al-Abood, Bennett, Hernandez, Ashford & Davids, 2002; Zachry, Wulf, Mercer & Bezodis, 2005).

A few researchers have also looked at the results of transfer tests, in addition to retention tests, in order to quantify learning. Transfer tests allow investigators to determine the effects of the independent variable on performance conditions that differ from those under which the skill was practiced. While the findings of studies using retention tests have demonstrated that attentional focus effects are persistent over time, the use of transfer tests allows for the assessment of whether or not motor learning is achieved under the two attentional focus conditions across settings (Totsika & Wulf, 2003). The study by Totsika & Wulf (2003) required participants to ride a Pedalo (an apparatus on which the subject stands on two foot-sized platforms with wheels, and moves by alternately pushing the upper platform forward and downward). After participants practiced riding the Pedalo normally while focusing on either their feet (internal focus) or the platforms (external focus), they were asked to perform a series of transfer tests that included riding the Pedalo under time constraints, riding it backwards, and riding it while performing a cognitive task (counting backward in threes). The findings from this study showed that the external focus group not only did better in practice, but also did better under all three transfer tests than the internal focus group.

Reasons for the Advantages of an External Focus of Attention

The studies reviewed above suggest that giving learners instructions that direct their attention to the effects of their movements (i.e., induce an external focus of attention) allows for enhanced learning of motor skills. It is believed that when

performing a task under external focus conditions, the performer's movements are executed with greater automaticity than when the performer is concentrating on his or her own movements (Wulf, McNevin & Shea, 2001). Henry (1953) demonstrated the ability of the motor system to control movements automatically. In his study, participants were instructed to hold a lever at a constant position and to compensate for changes in pressure that were applied to the lever. The results of the study found that participants responded to minimal changes in the position of the lever, although the pressure required for conscious perception of a change was about 20 times greater than the pressure that participants actually responded to. This finding seems to demonstrate the effectiveness of automatic motor control processes in comparison with more conscious control processes (McNevin et al., 2000).

According to the "constrained action hypothesis," attempts to control one's own movements consciously (internal focus) disrupt functioning of the motor system by interfering with automatic control processes (Wulf et al., 2001). In contrast, focusing on the effects of one's movements (external focus) *promotes* the use of automatic control processes, allowing the motor system to self-organize more naturally. The study by Wulf et al. 2001 supported this view by demonstrating faster and more frequent adjustments of a balancing task on a stabilometer with external focus conditions as opposed to internal focus conditions. The frequency of these movement adjustments imply an automatic, reflex-type mode of control. Furthermore, faster reaction times suggest that the movement is being performed at a greater degree of automaticity, and with reduced attentional demands. Thus, this study also shows that movements are controlled more

automatically under external focus conditions and that less attentional capacity is required for their control (Wulf et al., 2001).

In addition, studies have looked at differences in EMG activity as a result of attentional focus in order to provide additional evidence for the constrained action hypothesis. Vance, Wulf, Töllner, McNevin and Mercer (2004, Experiment 1) looked at EMG activity during a biceps curl task to measure the differences in electrical activity associated with muscle contractions under internal and external focus conditions. Participants were instructed to focus on either the movements of the curl bar (external focus) or on their arms (internal focus). The results showed reduced integrated EMG activity as well as faster movements under external focus conditions. Vance et al. (2004, Experiment 2) found that even when movement time was constrained, integrated EMG activity was also reduced under external focus conditions. Zachry et al. (2005) recorded EMG activity during basketball free throws. Again, groups of participants focused internally (on their wrist motion) or externally (on the basket). These results also found lower EMG activity as well as increased accuracy under external focus conditions. These EMG studies provide more insight into how the nervous system operates to produce attentional focus effects. External focus promotes greater coherence between sensory input and motor output (McNevin & Wulf, 2002). Since only the necessary number of motor units required to produce a desired outcome are recruited during external focus, the resulting automaticity yields a more economical movement (Vance et al., 2004).

Purpose of the Present Study

The effects of adapting an external focus of attention while training in dyads may have many implications for learning complex skills. In the present study, a golf putting

task will be used in order to look at dyad training with an emphasis on the dialogue used between partners. The dialogue will involve cues that will generate either an external or internal focus. This will determine the impact that dyad training and attentional focus will have on learning in the performance of a golf putt. Based on the previously discussed literature, it is predicted that the dyad group that utilizes an external focus will perform the best.

CHAPTER 3

METHOD

Participants

Participants were students selected from UNLV. Inclusion criteria were that they had not received any professional golf training/lessons in the past, and that they did not play golf on a regular, consistent basis. All participants were asked to sign a written informed consent. Forty participants (26 men and 14 women) were involved in the study. The participants were aged 20-37 years (mean 24.78 ± 3.56 years). Participants were randomly assigned to either internally focused or externally focused treatment conditions, with equal numbers in each condition. The pairs were assigned based first upon the availability of the participants. In some cases, the participants were familiar with each other and volunteered to participate as partners. In other cases, participants volunteered individually. In these cases, subjects were randomly assigned partners. Dyads were formed regardless of gender or age, although the majority of the groups were of a male/male ratio and male/female ratio simply because more males participated. All 40 participants were seen one day after their practice phase for a retention test. The study received approval from the University's Institutional Review Board.

Apparatus and Task

The experiment was performed on an artificial putting green located inside the Motor Behavior Laboratory at UNLV. The participants' task was to hit standard golf balls towards a square grid (0.914 m x 0.914 m) that was laid out on the putting green (3.7 m x 2.5 m) with a standard size golf putter (0.9 m). This grid was divided into quadrants, with the origin of the axis being the center of the grid and the target that they

were aiming for. Each quadrant of this grid was of equal size (0.457 m x 0.457 m). Each point on the grid was of equal distance from the other, they were laid out 7.617 cm apart. The target, or center axis of the grid, was laid out 2.54 m from where the putt took place. The scores were given as the ball landed on the grid, with (6,6) being a "hole in one" or the center of the axis. If they missed the target completely, scores of zero (0,0) were given. If the ball landed between the points on the grid, scores were given a half point if they were closer to the center, or whichever point on the axis that the ball was closest to. For instance, if the ball landed in the center of a square, it was given that point plus a half. If the ball landed closer to the axis of the point, it was rounded off to that point. Figure 1 shows an illustrative example of this scoring system.

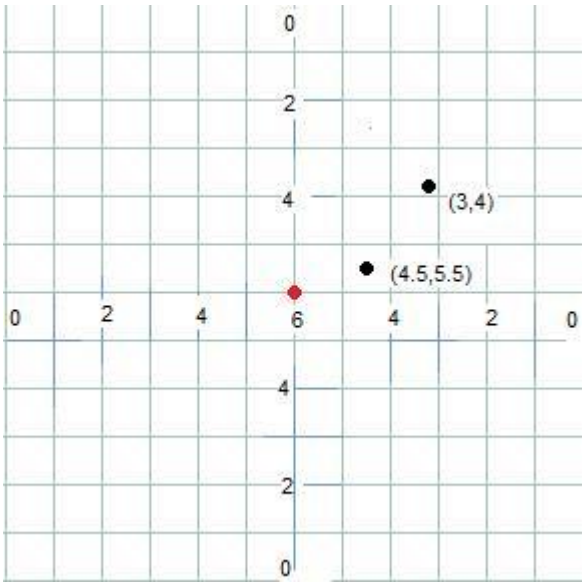

Figure 1. Schematic of scoring paradigm.

Procedures

All participants received general instructions regarding the task. Specifically, the experimenter described and demonstrated the basic technique of the golf putt to each participant. All participants received the same instructions regarding grip, stance, and posture. Participants were given a written set of instructions to verbalize to their partners during practice (see Table 1), and were similar to those from a previous study on attentional focus with a golf putt done by Poolton, Maxwell, Masters, and Raab (2006). These instructions were matched across conditions, and designed to generate either an internal or an external focus. The instructions for the internal focus groups included emphasis on the hands, specifically, moving them back a short distance and swinging them forward with a smooth action along a straight line. The instructions for the external focus groups included focus on the club, specifically moving the club back a short distance and swinging it forward with a smooth action along a straight line. These instructions were explained to the participants before the practice phase began. Although the participants were encouraged to remind their partners of these instructions, they were also asked to communicate to each other in a normal, every-day conversation type of way, and to give whatever advice to each other that they saw fit while remaining in the focus of attention that they had been given. The conversations within the groups during practice were recorded with a tape recorder in order to better explain the nature of the verbal interactions that occurs between partners.

Internal Rules	*External Rules*
Move your hands back a short distance	Move the club back a short distance
Swing your hands forward with a smooth action	Swing the club forward with a smooth action
Adjust the speed of your hands to apply appropriate force	Adjust the speed of the club to apply appropriate force
Adjust the angle of your hands to attain the correct direction	Adjust the angle of the club to attain the correct direction

Table 1. Rules given to the groups during learning.

The participants were randomly divided into four dyad groups: dialogue and observation with external focus, dialogue and observation with internal focus, dialogue and no observation with external focus, and dialogue and no observation with internal focus. In each group, two participants practiced in alternating dyad format. Specifically, while Partner 1 performed one trial, Partner 2 observed if they were in an "observation" group or turned their back if they were in a "no observation" group. When a partner in the "no observation" group was giving instructions, the partner performing the task would verbally communicate the results of his/her performance. For instance, the performing partner would say whether they were close to the target or not, and would suggest to their partner to do what they did to improve the score.

All participants practiced the golf putt for 60 trials during practice, and performed 12 retention trials on the following day to assess learning effects. All participants alternated with their partner after every trial during practice. The dyad groups were required to engage in conversation with their partner after every 10 trials. All retention trials were performed individually. Performance was measured by how closely the ball landed to the center of the axis.

Data Analysis

To determine the accuracy of multiple shots from a single subject, an average of the subject's shots was used. This was determined by the average x value and the average y value of the shots being aggregated. From here, the absolute distance of the average of the shots from the center of the target was calculated to determine the accuracy of the total amount of shots.

The dependent variable in this study was accuracy. The independent variables were focus of attention (internal, external), observation (yes, no), and the deviations from the center of the target in the x- and y-dimension. The data were analyzed using Statistical Package for the Social Sciences (SPSS. Version 16.0). To analyze the data, errors were analyzed in the x and y dimensi**o**n separately. A 2 (observation: yes, no) x 2 (focus: internal, external) x 2 (dimension: x, y) x 6 (blocks of 10 trials) ANOVA was used for the practice phase with repeated measures on the last two factors. A 2 (observation: yes, no) x 2 (focus: internal, external) x 2 (dimension: x, y) ANOVA was used for retention. The alpha level used was 0.05.

CHAPTER 4

RESULTS

Practice

Putting Performance

The average error scores in the X-axis and Y-axis on each 10-trial block for the four groups during the practice phase are shown in Figures 2 and 3 (left panel), respectively.

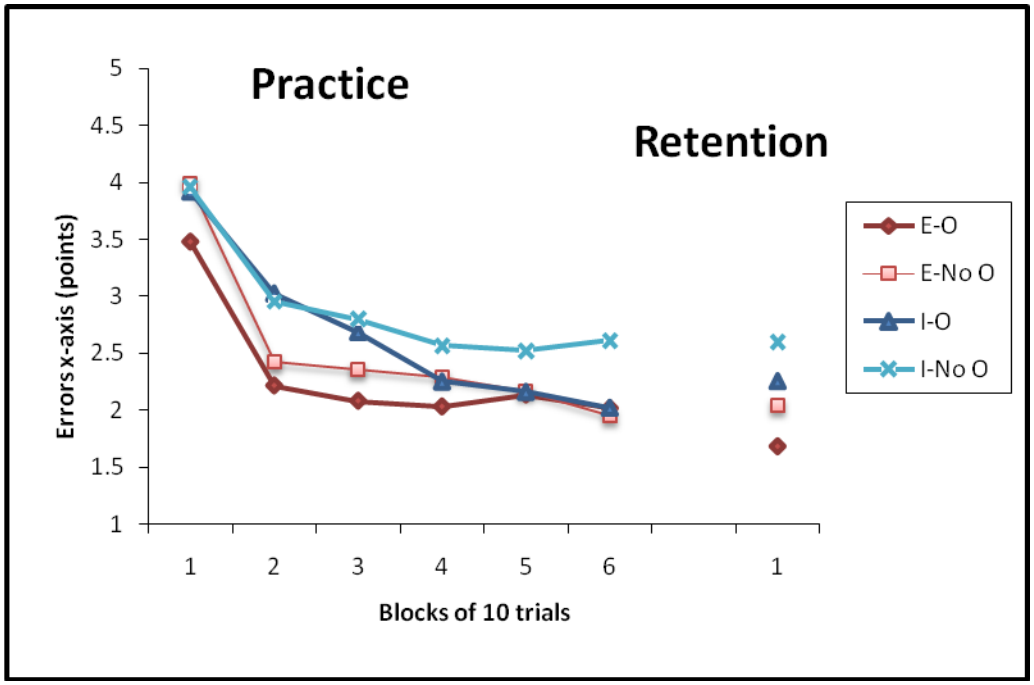

Figure 2. Accuracy scores in the X-dimension. Accuracy scores for the external/observation, external/no observation, internal/observation, and internal/no observation groups in practice and retention for the X-dimension. See text for statistics.

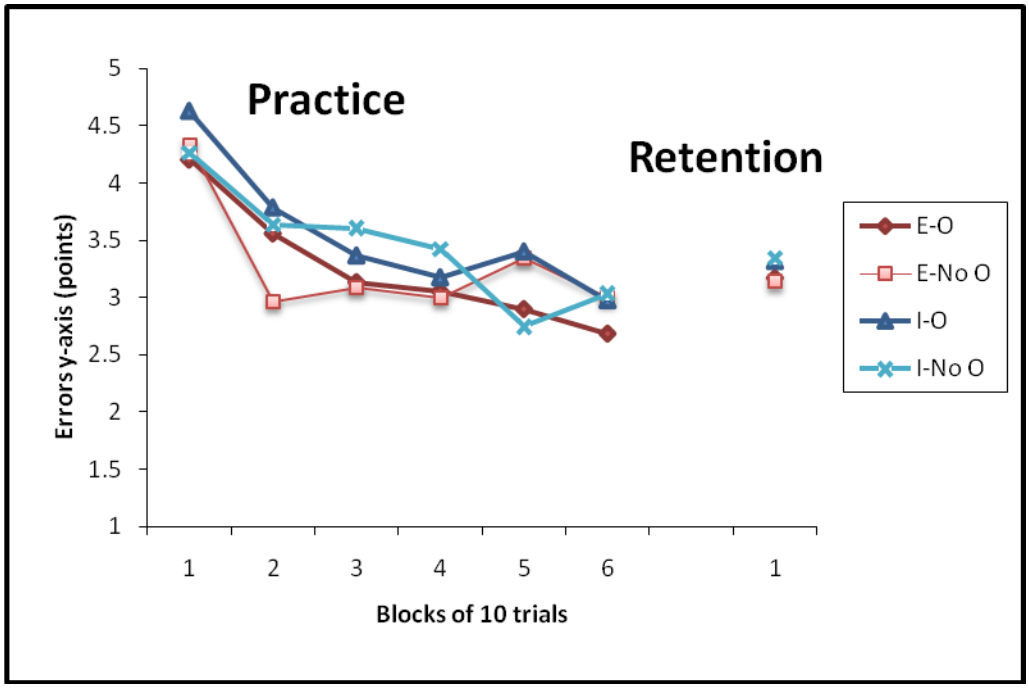

Figure 3. Accuracy scores in the Y-dimension. Accuracy scores for the external/observation, external/no observation, internal/observation, and internal/no observation groups in practice and retention for the Y-dimension. See text for statistics.

The main effect of blocks was significant, $F(5,180) = 32.83$, $p < .001$. The main effect of dimension was also significant, $F(1,36) = 212.57$, $p < .001$. Although the external observation groups tended to have lower error scores than the internal observation groups, the main effects of focus was not significant, $F(1,36) = 2.75$, $p = .11$. Also, the main effect of observation was not significant, $F(1,36) < 1$. The interaction of dimension x observation was significant, $F(1,36) = 5.51$, $p < .05$. Follow-up ANOVAs for each dimension (with alpha levels adjusted for multiple comparisons) were not able identify the source of this interaction. The interaction of dimension x block x focus x observation was also significant, $F(5,180) = 4.02$, $p < .01$. Again, post-hoc analyses did

not reveal the exact source of the interaction. None of the other interaction effects were significant.

Figures 4 and 5, respectively, illustrate a scatter plot of the location of each point on the grid where the ball landed for each trial of every participant in the practice phase, and in the retention test. These scatter plots allow for a visual depiction of the general direction in which the majority of the shots took place.

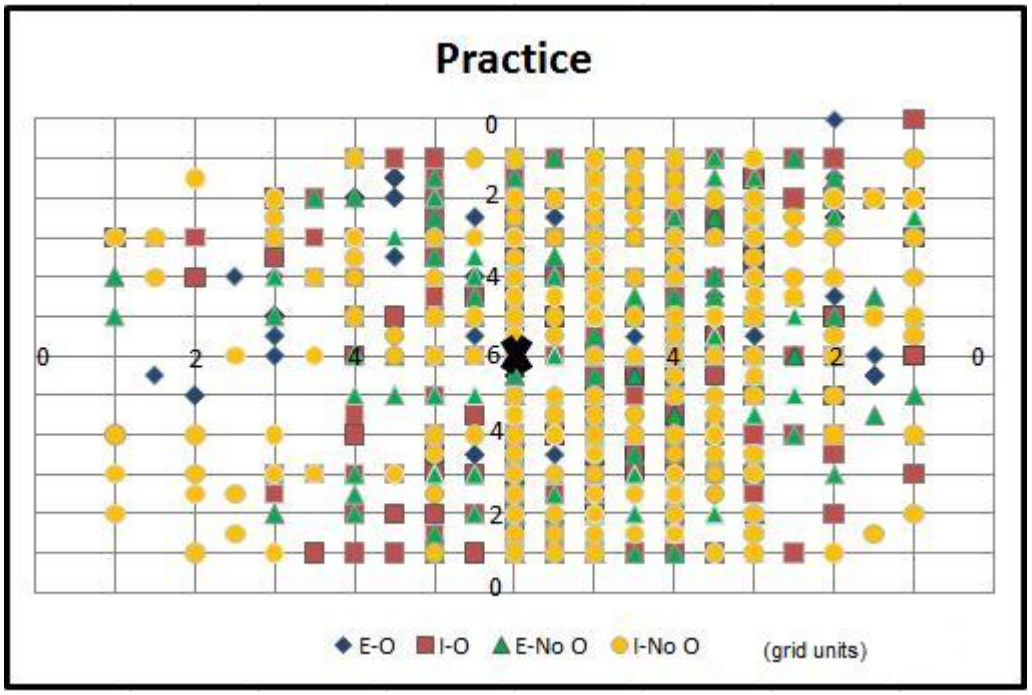

Figure 4. Scatter plot for practice phase. Scatter plot of the points on the grid where the ball landed in the practice phase.

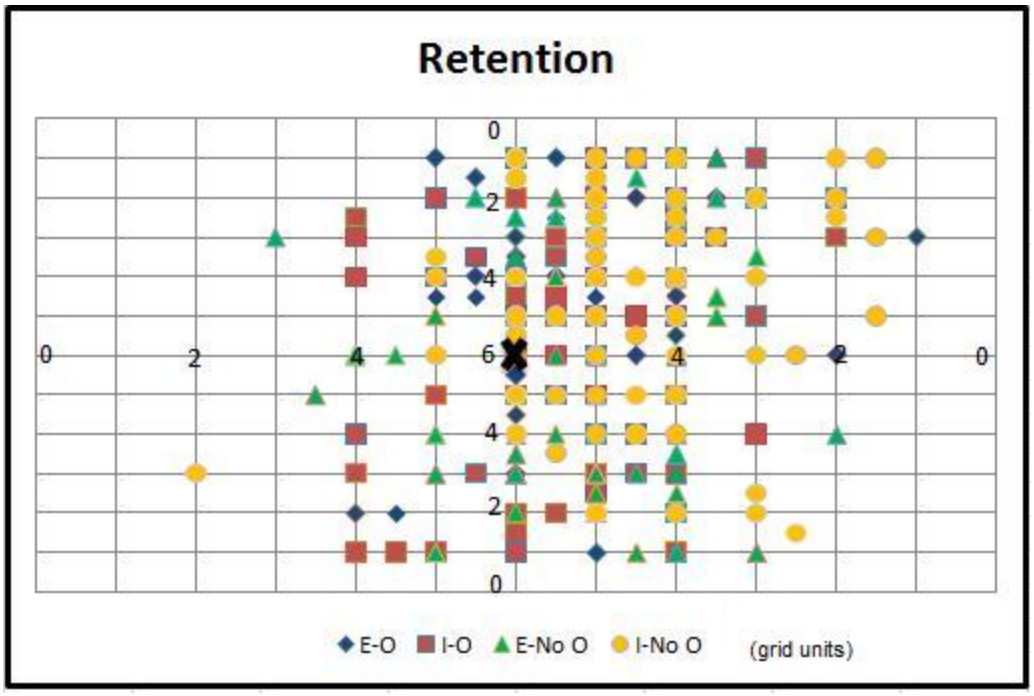

Figure 5. Scatter plot for retention test. Scatter plot of the points on the grid where the ball landed in the retention test.

Dialogue

During the practice phase, the dialogues between the participants were recorded (see Appendix 1). The main comments and advice that they gave to each other regarding their technique was transcribed. Table 2 shows the number of times that the key elements of external versus internal focus were talked about. Figures 6 and 7 are a graphical display of the frequency of these key elements in the external and internal groups.

	Obs Ext	Obs Int	No Obs Ext	No Obs Int
INTERNAL				
hands/wrists	2	5	2	3
shoulders		1		1
knees	2	2	2	1
feet		1		2
EXTERNAL				
putter	7	4	6	3
ball	2	4	1	6
target	1	3	4	3
swing	5	6	4	1
INTERNAL total	4	9	4	7
EXTERNAL total	15	17	15	13

Table 2. The number of times these items were talked about during practice.

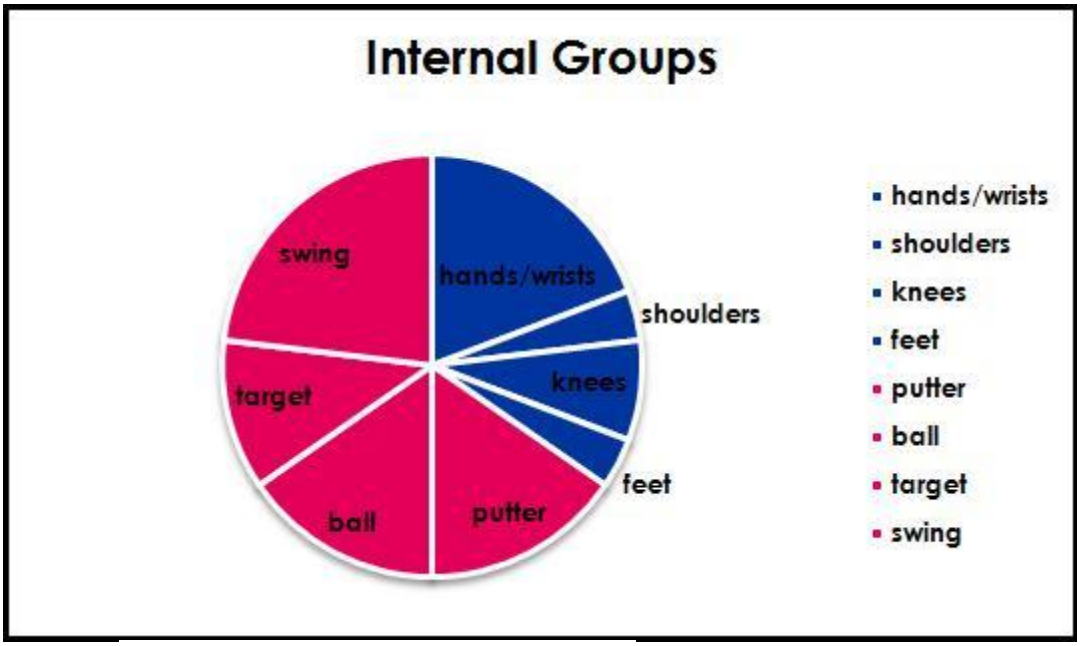

Figure 6. Dialogue chart for internal groups. The frequency of internal and external cues discussed in the internal focus groups.

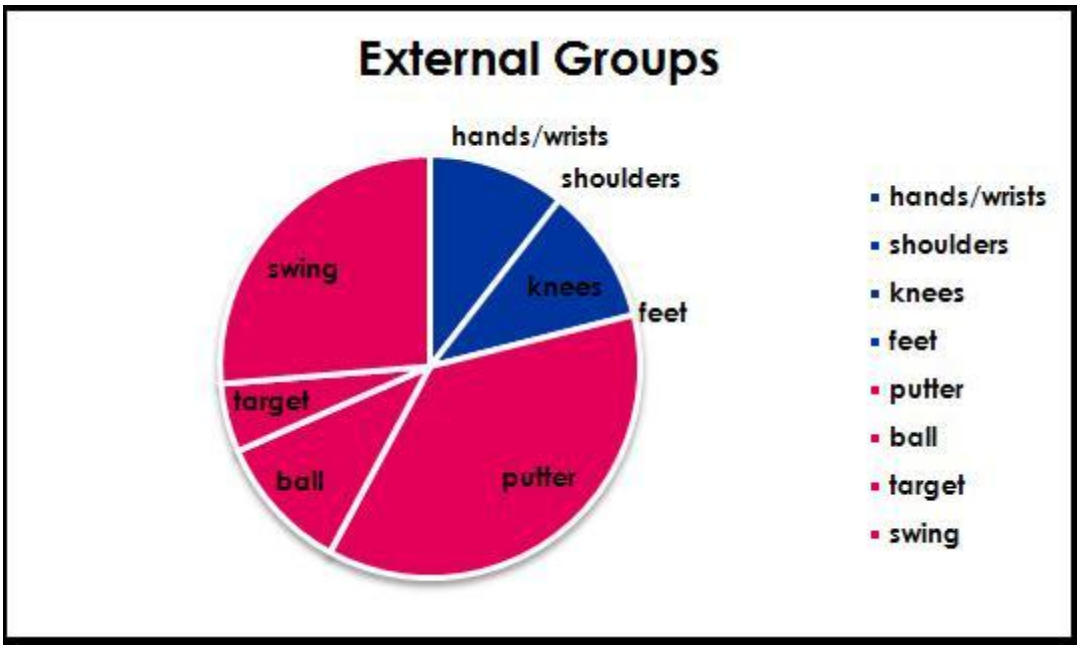

Figure 7. Dialogue chart for external groups. The frequency of internal and external cues discussed in the external focus groups.

Retention

Putting Performance

One day later, the external focus groups (external/observation, external/no observation) had significantly lower error scores than the internal focus groups (internal/observation, internal/no observation) (see Figures 3 and 4, right panel). The main effect of focus was significant, $F(1,36) = 5.346$, $p < .05$. The external focus groups had smaller errors than the internal focus groups in the X-dimension, but not in the Y-dimension. This was confirmed by a marginally significant interaction of dimension x focus, $F(1,36) = 4.13$, $p = .05$. The main effect of dimension was significant, $F(1,36) = 1.29$, $p < .001$. However, the main effect of observation failed to reach significance, $F(1,36) = 1.19$, $p > .05$. Thus, regardless of whether participants were able to observe another learner during practice, the external focus of attention instructions had a beneficial effect on learning.

CHAPTER 5

DISCUSSION

The purpose of the present study was to examine the influence that dyad training and attentional focus have on learning in the performance of a golf putt. While dyad practice and instructions inducing an external focus have previously been examined (Shea et al., 1999; Shebilske et al., 1992; Granados & Wulf, 2007; Wulf et al., 1998), it was unclear how much impact dialogue had on dyad training. In the present study, the design used allowed for an analysis of the interactive effects of dialogue with attentional focus instructions playing a key role in how the dyad groups formed their conversations with each other. Specifically, practice conditions were set up in order to steer the dialogue between partners to generate either an external focus or an internal focus. Results from previous studies have shown that participants practicing with a partner benefit most from observing their partners (Granados & Wulf, 2007), therefore a guided dialogue between the partners - whether they were observing each other or not - was created in order to determine the extent of the impact that dialogue plays in motor learning.

The participants did use and repeat their initial instructions that they had been given, depending on what group they were in. Those who were in the external focus groups would consistently continue to emphasize to their partners that they needed to focus on the putter, the ball, or the target. Those who were in the internal focus groups would remind each other to keep their focus on the hands, the movement action, and even on the knees and position of their feet. Although some of the groups would also have a tendency to teach each other based on their own previous knowledge of a golf putt, most

actually relied on, and in turn, instructed each other on the attentional focus instructions that they were given.

The results of this experiment replicate the learning benefits of external focus instructions found in previous studies (for a review, see Wulf, 2007). The average error scores decreased across the practice phase, although there were higher errors in the Y dimension. The retention test determined that focusing on the golf putter (external focus) resulted in better performance scores than focusing on the hands (internal focus). The results also showed that the dyad groups who observed their partners had no significant difference in accuracy from those who did not, indicating that it is the dialogue and instructions given by each partner that has an effect on learning.

The theoretical framework behind attentional focus is based on the "constrained action hypothesis." According to this theory, a conscious attempt to control one's own movements disrupts functioning of the motor system by interfering with automatic control processes (Wulf, 2007; Wulf et al., 2001). This study along with previous studies of attentional focus provides converging evidence that an external focus of attention allows for the use of these automatic control processes.

The findings in this study also suggest the influence of dialogue between partners weighed heavier than the ability to observe the other learner. Since all learners were novices in this study, the fact that there was more of an emphasis in their verbal directions toward each other may have played a larger role than learning by observation, as it did in previous studies (Granados & Wulf, 2007). If the dialogue had not been specifically directed towards yielding a focus of attention, the observation between participants may have played a greater part in the actual learning of the task. Because the

dialogue between the dyad groups had a very specific intent to generate an internal or an external focus, this aspect of the study shows that observation between dyads may play a smaller role in learning when paired with specific focus instructions.

Practical Implications

This study may have implications for the coaching and teaching of a new skill to groups of people. It is beneficial to have dyad groups working together, as shown here and in previous studies (Granados & Wulf, 2007; Shea, Wulf, & Whitacre, 1999; Arthur, Day, Bennet, McNelly, & Jordan,1997). It is also beneficial to have learners directed to an external focus of attention. When encouraged to focus on the movement effect, participants use more automatic control processes resulting in a more effective performance. It is typical for many golf coaches to give instructions that mainly come from an internal perspective, thus it would be beneficial to educate experts on the negative effects of internal focus of attention (Bell & Hardy, 2009; Newell, 2001). External focus of attention and dyad training may also have many benefits in the field of injury rehabilitation.

Future Research Recommendations

Future studies using motion analysis may be better able to explain the differences in mechanisms used when using an external versus an internal focus of attention. Furthermore, given the benefits of observation and dyad practice shown here and in previous studies (e.g., Granados & Wulf, 2007), it is likely that practicing with another learner has beneficial effects that go further than a simple breakdown of observation versus dialogue. Interaction with another person may lead to a difference in goal-setting, competition, and/or nervousness that one may not have if they were practicing on their

own. Future studies should examine to what extent these factors are affected in dyad training. Additionally, other studies can be done to look at personality types, and how that affects learning alone versus with a partner. The actual partner that one is performing with may be a determining factor of whether they are going to learn well from that person or not. Certain factors such as gender, age, or social differences between people, may affect the natural interactions that are assumed to occur within a dyad group.

Limitations

A number of limitations were evident in this research study. One limitation is that there are difficulties in terms of controlling whether or not the participants remained in their given attentional focus condition. The analysis of the dialogue between the dyad groups demonstrated that even the internal groups spoke more about external cues than internal cues. They did discuss more internal cues than the external groups did, however, which shows that the participants were attempting to remain in an internal focus. This could be evidence that discussions of external cues come about naturally and automatically, and internal focus requires a more forced state of thinking.

It is also worth noting that the scoring system of the shots gives a limited range from which to measure accuracy. Since a score of (0,0) was given for any missed shot it eliminates the ability to determine in which direction the missed shot occurred. It also affects the outcome of the interaction of the total average value of the shots.

Summary

In summary, this investigation provided a unique experimental approach of combining areas of research done on how dyad training and attentional focus influence

motor learning. The findings from this study confirm the effectiveness of dyad practice and external focus of attention on improving motor learning. These results extend the existing research that has been done in dyad training by showing the effect that the contents of discussion have on learning.

APPENDIX 1

TRANSCRIPT OF DIALOGUE

Group 1 – Observation/External

P1 - Make your swing a lot smoother, bring the club back a little further and avoid hitting with such a jerky motion

P2 – You're doing good you are hitting it really straight, maybe with just a little bit more force because you keep undershooting

Group 2 – No Observation/External

P3 – Bend your knees a little more, just let it go just let the club swing and follow through but don't hit it too hard. You're doing good!

P4 – You're doing good, have a little more control of the golf club but I think you have the force pretty much down.

Group 3 – Observation/External

P5 – Don't hit it so hard, turn your body to the left, keep the club on the ground don't lift it up so high

P6 - Think about using more force on your swing, hit it harder, think about moving the club in a straight line, swing it straight

Group 4 – No Observation/External

P7 – I think your technique is getting better, work on the speed, think about how you're moving your hands

P8 – You need to work on your speed of the club, use your hands more for direction, and hit it more towards the middle, you keep veering to the left

Group 5 – Observation/External

P9 – Aim further back since you keep undershooting, try not to hit too hard though

P10 – Grip the club a bit lighter, hold it lighter you are flexing too hard, and put in a little more wrist flexion

Group 6 – No Observation/External

P11 – You have a good technique, just be careful not to put too much force on the swing, you keep going over the target

P12 – Keep the club steady and smooth throughout the follow through also, don't hit too hard

Group 7 – Observation/External

P13 – Make sure you keep focus on the club, make sure you bring it back and swing forward like a pendulum swing, follow through every time don't just punch it, make sure you follow through

P14 – Don't swing the putter too hard, keep your arms straight and your knees slightly bent, follow through with your swing

Group 8 – No Observation/External

P15 – Stay relaxed, imagine the hole 3 feet in front of where you're supposed to hit it, then you won't overshoot or hit too hard

P16 – It helps to bend your knees when you swing, keep your club straight as you swing forward

Group 9 – Observation/External

P17 – Keep your knees slightly bent, don't bend your wrists when you swing the putter, make sure you follow through

P18 – Make sure your not putting too much force on the swing, I keep going back too far and it overshoots the target

Group 10 – No Observation/External

P19 – Keep your stroke straight when you hit it, don't use too much pressure, make sure you aim at the center

P20 – Don't think about your body just swing the club in a straight line, keep your eye on the target

Group 11 – Observation/Internal

P21 – You're putting too hard, lighten up the grip, and don't put too much muscle force into it. Bend your knees, keep it softer

P22 – Follow through a little better with the club, pull the club back and swing it forward the same distance, like a pendulum, move your hands in that direction like a pendulum, and the club will just follow

Group 12 – No Observation/Internal

P23 – Aim slightly to the left, because you keep curving the ball, put a little more power into your swing, follow through, hit it lightly

P24 – keep your feet flat on the ground, you keep lifting, try to concentrate, stop talking so much, give it your best

Group 13 – Observation/Internal

P25 –Keep your eye on the target even while you are hitting the ball, concentrate on staying consistent, think about the force you are applying to the ball, keep it a light swing and don't hit with too much force

P26 - Don't hit the ball so hard, focus on the back swing, forward swing, follow through, adjust your feet, keep them straight

Group 14 – No Observation/Internal

P27 – Concentrate on staying consistent, keep your feet flat, aim directly at the target, take your hands back a bit further

P28 – Keep your eye on the ball, try to hit it straight, concentrate on the force you're applying to the ball

Group 15 – Observation/Internal

P29 – Don't hit the ball so hard, you are putting too much force into your swing, your back swing and forward swing should be lighter, adjust your starting position

P30 – Aim at the target, don't hit so hard, you are going over the target so adjust your force, keep focus on your hands, don't move them back so hard

Group 16 – No Observation/Internal

P31 – Bend your knees and lean your chest over the ball, keep a light grip on the club

P32 – Make sure your shoulders are over the ball, keep your elbows straight, keep your eye on the ball at all times

Group 17 – Observation/Internal

P33 – It helps to look down at your hands, try to move them back just a few inches and the club will just swing forward on its own

P34 – Don't think so hard, your body will just naturally flow relax your shoulders especially, keep your focus on the hands, don't put so much force into the swing

Group 18 – No Observation/Internal

P35 – Aim slightly beneath the target if you keep overshooting like I do

P36 – Keep a light grip on the club, imagine the hole bigger

Group 19 – Observation/Internal

P37 – Imagine a straight line going towards the hole, and think about moving your hands in the direction of that line, go easy on the swing

P38 – Just slightly bend your knees, make your body feel loose so you don't hit too hard

Group 20 – No Observation/Internal

P39 – Focus on having less pressure on your grip, your hands will just swing back slightly, keep the putter straight, keep your eye on the target

P40 – Aim slightly to the left, make sure your hands and wrists stay locked, and keep your eye on the ball

APPENDIX 2

IRB APPROVAL

Biomedical IRB – Expedited Review

Approval Notice

NOTICE TO ALL RESEARCHERS:

Please be aware that a protocol violation (e.g., failure to submit a modification for any change) of an IRB approved protocol may result in mandatory remedial education, additional audits, re-consenting subjects, researcher probation suspension of any research protocol at issue, suspension of additional existing research protocols, invalidation of all research conducted under the research protocol at issue, and further appropriate consequences as determined by the IRB and the Institutional Officer.

DATE: October 22, 2007

TO: **Dr. Gabriele Wulf**, Kinesiology

FROM: Office for the Protection of Research Subjects

RE: Notification of IRB Action by Dr. Charles Rasmussen, Co-Chair

Protocol Title: **The Effects of Observation, Dialogue and Attentional Focus in Dyadic Training Protocol**

Protocol #: 0709-2450

This memorandum is notification that the project referenced above has been reviewed by the UNLV Biomedical Institutional Review Board (IRB) as indicated in regulatory statutes 45 CFR 46. The protocol has been reviewed and approved.

The protocol is approved for a period of one year from the date of IRB approval. The expiration date of this protocol is October 16, 2008. Work on the project may begin as soon as you receive written notification from the Office for the Protection of Research Subjects (OPRS).

PLEASE NOTE:

Attached to this approval notice is the **official Informed Consent/Assent (IC/IA) Form** for this study. The IC/IA contains an official approval stamp. Only copies of this official IC/IA form may be used when obtaining consent. Please keep the original for your records.

Should there be *any* change to the protocol, it will be necessary to submit a **Modification Form** through OPRS. No changes may be made to the existing protocol until modifications have been approved by the IRB.

Should the use of human subjects described in this protocol continue beyond October 16, 2008 it would be necessary to submit a **Continuing Review Request Form** *60 days* before the expiration date.

If you have questions or require any assistance, please contact the Office for the Protection of Research Subjects at OPRSHumanSubjects@unlv.edu or call 895-2794.

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2. Wulf, G., Granados, C., & Dufek, J.S. (2007, June). Increases in jump-and-reach height through an external focus of attention. Poster presented at the Annual Meeting of the *North American Society for the Psychology of Sport and Physical Activity (NASPSPA),* San Diego, CA.
3. Granados, C., & Wulf, G. (2007). Enhancing motor learning through dyad practice: Contributions of observation and dialogue. *Research Quarterly for Exercise and Sport, 78,* 197-203.
4. Wulf, G., Zachry, T., Granados, C., & Dufek, J.S. (2007). Increases in jump-and-reach height through an external focus of attention. *International Journal of Sports Science & Coaching, 2,* 275-284.

Thesis Title: The Effects of Observation, Dialogue, and Attentional Focus in Dyadic Training Protocol

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