

6-2016

Mental and Physical Practice: Comparing their Effects on Hand-Eye Coordination Tasks

Ryan M. Dyck
Lindenwood University

Follow this and additional works at: https://digitalcommons.lindenwood.edu/psych_journals



Part of the [Psychology Commons](#)

Recommended Citation

Dyck, Ryan M. (2016) "Mental and Physical Practice: Comparing their Effects on Hand-Eye Coordination Tasks," *Undergraduate Psychology Research Methods Journal*: Vol. 1 : Iss. 19 , Article 11.
Available at: https://digitalcommons.lindenwood.edu/psych_journals/vol1/iss19/11

This Article is brought to you for free and open access by the Psychology, Sociology, and Public Health Department at Digital Commons@Lindenwood University. It has been accepted for inclusion in Undergraduate Psychology Research Methods Journal by an authorized editor of Digital Commons@Lindenwood University. For more information, please contact phuffman@lindenwood.edu.

Mental and Physical Practice: Comparing their Effects on Hand-Eye Coordination Tasks

*Ryan M. Dyck*¹⁰

Lindenwood University

The present study aims to determine whether mental or physical practice is more beneficial immediately prior to a hand-eye coordination task. In order to test this the present experiment uses a game similar to beer/water pong, a common party game among college students, and records the amount of cups made. The study uses a pre-test post-test design to account for individual differences on pong playing ability. In between the two tests, participants underwent either mental or physical practice. Two hypotheses are present for this study: first that all participant's post-test scores will be higher than their pre-test scores, and second, that participants in the mental practice condition will have higher post-test scores than those in the physical practice condition. Using a 2 (practice) X 2 (trial) ANOVA, it was concluded that there was no statistically significant difference between the two trials, nor between the two different practice conditions. The present study concludes that future research should utilize more trials in both the post and pre-test as well as having a longer practice period.

Since the beginning of sport, individuals have endlessly tried to improve their performance through practice. In modern sports, coaches and athletes use the most advanced technology to learn how to push the body to its limits and prepare it for competition. Research in this area is persistently conducted, and records are constantly broken. Take the 2016 Olympics for example, where 27 world records were set (Olympics, 2016). However, it is not only physical training that affects one's performance, psychological or mental practice often plays an important role in the success of an athlete. The extent to which mental practice aids individuals

¹⁰ Ryan Dyck, Psychology Department, Lindenwood University. Correspondence regarding this paper should be addressed to Ryan Dyck at Lindenwood University Psychology Department, Lindenwood University, 209 South Kingshighway, St. Charles, MO, 63301, or email at rmd632@lionmail.lindenwood.edu

has been a hotly debated topic in sport, health, and psychological research (Driskell, Cooper, & Morgan, 1994). For example, it has been found that imagery can be beneficial for stroke victims in regaining upper limb motor function (Crosbie, McDonough, Gilmore, & Wiggam, 2004); moreover, focused imagery has a significant effect on one's physiological response (Hecker & Kaczor, 1988). Thus it can be concluded that the mind plays an important role in the functioning of one's motor movement as well as their physiological responses. The next logical question then becomes; can, and how, does the mind affect one's performance in sport?

Previous research has indicated that mental practice is better than not practicing at all, and that mental practice seems to be more beneficial for motor tasks that require more cognition (Landers, 1983). Research on sport-specific mental practice further suggests that negative imagery is detrimental to the successful completion of a task, and that mental practice works best when it is combined with physical practice and implemented at the beginning stages of skill acquisition (Lejeune, Decker, & Sanchez, 1994; Taylor & Shaw, 2002).

Using previous research as a foundation, this experiment is designed to test the most effective way to prepare for a known or learned cognitive based motor task. In order to do this, the experiment will subject half of the participants to a mental practice condition and the other half to a physical practice condition. In an attempt to acquire as many participants as possible, the cognitive motor task chosen was water/beer pong. This game is one that is commonly played at parties around college campus, and involves shooting a ping pong ball into a party cup.

Participants of this particular study had 10 chances to shoot a ping pong ball into a party cup partially filled with water. After this initial pre-test participants were subject to one of the aforementioned conditions. In the mental practice condition participants were shown three basic mental practice techniques (relaxation, visualization, and body rehearsal) and left alone to practice them for 5 min. In the physical practice condition participants were shown the generally accepted technique for beer/water pong, and then left alone to practice for 5 min. After participants underwent their respective practice they repeated the pre-test. I hypothesized that participants in both conditions would improve their make percentage in the second trail, and that participants in the mental practice condition would improve significantly more than those in the physical practice condition.

Method

Participants

In this study there were 27 participants. All of the participants were between the ages of 18-64. The sex of the participants was not asked as it was not pertinent to this study. There were 25 participants who had previous experience playing a game that involved a similar shooting motion to the task in the study. Of these 25 participants, 6 considered themselves to have poor shooting skills while 13 considered themselves to be proficient at the task, and 6 considered themselves to be great at the task. Of all the participants in the study, 17 play sports

competitively while 10 do not. Finally, 9 participants have received formal mental training while 19 had never received any formal training. Of these 9, only 5 are still receiving training.

Participants for this study were recruited by the posting of fliers around campus and through the Lindenwood Participant Pool (LPP) using a data management system called Sona Systems. There were 7 participants recruited using fliers. These fliers were posted on bulletin boards around Lindenwood University's campus with the permission of the dean of each building. Participants recruited through this method received no compensation other than the knowledge that they contributed to the advancement of scientific knowledge. There were also 20 participants who were recruited through the LPP. The LPP is designed to help researchers at Lindenwood gain participants for their studies. To do this the LPP offers students in introductory classes from various disciplines the opportunity to earn one to two extra credit points for participating in a given study. For this particular study, participants were given one extra credit point toward their LPP participating class for their participation (points are determined by the length of the study).

Materials and Procedure

Prior to the arrival of participants, the testing room was set up so that 10 red solo cups partially filled with water were arranged in a triangular formation. Two ping pong balls were placed at the other end of the table. Once participants arrived, they were asked to sit down at which time they were handed the informed consent form. If participants agreed to participate,

they were given a questionnaire (see Appendix A). After participants completed the questionnaire, they were randomly selected to be in either the mental or physical practice condition. In order to randomize selection all even numbered participants underwent the physical practice condition while the odd numbered participants underwent the mental practice condition. After placed into their respective condition, participants were informed of the potential rewards: one sour patch kid for every cup made and a \$10 dollar iTunes gift card if they made all 10 cups. Participants then underwent the pretest. During the pretest, participants shot 10 ping pong balls into the triangular formation of red solo cups. Each time a participant made a cup, the cup was removed from the formation to ensure that the same cups were not counted twice.

After completing the pretest, participants underwent their respective condition. In the physical practice condition, participants were offered a 1 min tutorial on the established techniques for “beer pong,” a game that utilizes the same shooting concept. After the tutorial, participants were left alone to practice for 5 min. In the mental practice condition, participants were shown three basic mental training techniques. The first was a breathing exercise designed to release tension in the participant’s body. The exercise consisted of participants breathing in through their nose for 4 s, holding their breath for 4 s, and then exhaling for 4 s out of their mouth in a controlled manner. Participants were told that this exercise could be used to control their arousal level if they felt themselves becoming nervous or overly aroused.

The next exercise that participants were shown was imagery. In this exercise, participants were asked to close their eyes and visualize themselves correctly executing each step involved in making a shot. Participants were informed that the more vividly they visualized the process the greater their chance of making the shot. Finally, participants were shown body rehearsal techniques. During this explanation, participants were asked to go through the motions of shooting the ping pong ball and visualize themselves correctly making the shot. After each of the three mental training techniques were demonstrated and explained, participants were left alone for 5 min to practice these techniques. To ensure that participants did not perform any physical practice, the ping pong balls were taken from the room.

After 5 min had passed, participants of both groups participated in the posttest portion of the experiment. This portion of the test was exactly the same as the pretest and involved the same potential rewards as the pretest. Results of the participants were recorded, feedback letters were handed out, and participants were asked if they had any questions pertaining to the study. If participants did have questions they were answered to the best of my ability, and then participants were dismissed. Those participants recruited through the LPP were also given their participation receipts to turn in for extra credit.

Results

The hypotheses I proposed for this study were first that the mean scores of trial two would be greater than those of trial one, and second, that the mean difference between trial one

and trail two would be greater for those in the mental practice condition. In order to determine if these research hypotheses were correct, I conducted a 2 (practice) X 2 (trial) mixed ANOVA to determine if the number shots made was affected by practice type, and trial number. There was not a significant main effect of trial as trial one ($M = 2.67, SD = 1.52$) was not significantly lower than trial two ($M = 2.59, SD = 1.39$), $F(1, 25) = 0.311, p = 0.582$. Thus the research hypothesis that participants would significantly improve on the second trial was not supported.

The second hypothesis concerned the interaction between trial and training. There was not a significant interaction as the change in the mental practice condition ($M = -0.23, SD = 1.79$) was not significantly different from the change in the physical practice condition ($M = 0.071, SD = 1.86$), $F(1, 25) = 0.185, p = .671$. Therefore, the null hypothesis was supported.

Discussion

The present study aimed to determine whether mental or physical practice was more effective immediately prior to a hand-eye coordination task. In order to determine this, I examined whether practice in general had a positive effect on participants' scores, and then whether this effect was greater for participants in the mental or physical practice condition. After analyzing the data there was no significant difference in participants' scores between trial one and trial two. Moreover, the practice condition in which participants were subjected to did not significantly affect their results either way.

After analyzing the data and finding no significant correlations I went back and reviewed previous research in order to determine the potential reasons why this may have occurred. In Taylor and Shaw's (2002) study on putting performance they found that only negative imagery had a significant effect on putting (positive and no imagery were also used). These findings suggest that negative imagery is more powerful than positive imagery. However, after comparing these results and procedure with my own study it appears as though there may be another factor: time. In Taylor and Shaw's (2002) study, participants went through a guided imagery process prior to every fourth putt. Participants did not have the time to practice and enhance the skill of imagery. This coincides with the present study as participants here did not have a substantial amount of time to practice and refine their visualization, relaxation, and body rehearsal skills either. What this suggests is that positive mental practice is like any other motor skill; it must be practiced and refined before its benefits begin to show quantitative results.

The preceding proposal is further supported when reviewing a meta-analysis of studies designed to test the effects of mental and physical practice. In all of the studies reviewed by Landers (1983), the ones that showed statistical significance in favor of mental practice had individuals participate in the condition over a period of at least five days. Furthermore, in Lejeune, Decker, and Sanchez's (1994) study, on the effects of mental practice on ping pong skills, participants underwent a mental training program that lasted seven days. The results of this study indicated that mental practice had a positive effect on participants' performance of

table tennis skills. Thus mental training takes time for its effect to be noticeable. In future studies I recommended that researchers have participants undergo mental training for at least a five-day period for a minimum of 20 min per day as per previously successful studies.

After conducting preliminary analyses and reviewing past literature I was interested to see if there were any data to support previous findings that the mind plays an important role in the successful completion of hand-eye coordination tasks. To do this, I decided to run a Pearson's product-moment correlation coefficient analysis (Pearson's r) comparing participants perceived task competence with their results in the two trials. In order to minimize error, I did not include the two participants who had not played beer/water pong before. The test yielded no significant findings; however, there was a positive correlation that approached statistical significance ($r(23) = 0.302, p = .071$). The implications of these findings are the following. First, the higher a participant's perceived competence, the more he or she improved from trial one to trial two. This is especially interesting because on average the whole of participants actually did slightly worse on the second trial than the first. The test also suggests that confidence plays an important role in the successful completion of a motor task.

The last important finding of this study was that on average, participants of both conditions did worse, albeit not significantly, on the second trial. This result goes against one's intuition as it is commonly accepted that "practice makes perfect," or at the very least, practice will aid in an individual's ability to successfully complete a task. In order to explain this, I will

use one participant's comment combined with some previous research related to flow states. One particular participant did very well on the first trial making half of the cups and netting the second highest score of all participants. After providing the participant with instructions on how to best mentally practice and allowing to him to do so, trial two commenced. In this trial, however, the participant only made 1 of the 10 cups, suggesting that the mental practice actually had a negative effect on his performance. After the participant was done he asked me a few questions and stated that although he felt more confident during the second trial he was also more concerned with the result. Moreover, he stated that he felt as though he was no longer reacting to the cups, but was analyzing his movement and trying to figure out why he missed. In the applied world of sport psychology many practitioners would call this paralysis by analysis which basically means that the athlete is not able to perform to his or her potential due to one's over analysis of the situation. This falls in line with research on flow or optimal states which highlights the fact that in a flow state one's brain hovers in a state of consciousness just above the dream level (Fowler, 2015). This means that one's brain is not analyzing a situation, but merely going along with the action. The individual is so immersed in the activity that he or she is not concerned with the specific how so long as the task is completed.

Although the present research did not yield any statistically significant data, it did provide valuable information pertaining to mental practice, the time it takes, and future research implications. The study's lack of statistically significant findings one way or another combined

with previous research suggest that in order for the effects of mental or physical practice to take place the practice must be longer than 5 min and should take place over a period of at least 5 days. When conducting future research, I recommended that researchers keep this and three other major things in mind. First, I recommended that there be both quantitative as well as qualitative analysis especially if the quantitative data is limited. One of the major downfalls of this study was that there was not enough data per participant to account for extraneous variables such as good or bad bounces. By assessing shots in a qualitative manner it will be easier to assess minor improvements that may not be quantitatively noticeable with the current sample size or until a later date. The second recommendation is to increase the amount of quantitative data per participant. By having participants undergo three to four trials per condition some of the previously mentioned extraneous variables could be eliminated. Moreover, the general tendencies of an individual tend to appear more in larger sample sizes. The third suggestion for future research deals with the makeup of conditions. Although it was not possible for this present study, due to the limited number of participants, I recommended that there be an additional group that incorporates both physical and mental training as their compounding effects may be greater than either one individually. All in all, the present study provided significant information that should influence future research, and ultimately will lead to a greater understanding of how to most effectively and efficiently practice motor tasks.

References

- Crosbie, J. H., McDonough, S. M., Gilmore, D. H., & Wiggam, M. I. (2004). The adjunctive role of mental practice in the rehabilitation of the upper limb after hemiplegic stroke: A pilot study. *Clinical Rehabilitation, 18*(1), 60-68. doi: 10.1191/0269215504cr702oa
- Driskell, J. E., Copper, C., & Moran, A. (1994). Does mental practice enhance performance? *Journal of Applied Psychology, 79*(4), 481-492. doi: 0.1037//0021-9010.79.4.481
- Fowler, J. (Producer). (2015, March 14). *The neuroelectricity of flow states*, with Steven Kotler [Video file]. Retrieved November 16, 2016.
- Hecker, J. E., & Kaczor, L. M. (1988). Application of imagery theory to sport psychology: Some preliminary findings. *Journal of Sport & Exercise Psychology, 10*(4), 363-373. doi: 10.1123/jsep.10.4.363
- Landers, D. M. (1983). The effects of mental practice on motor skill learning and performance: A meta-analysis. *Journal of Sport Psychology, 5*(1), 25-57. doi: 0.1123/jsp.5.1.25
- Lejeune, M., Decker, C., & Sanchez, X. (1994). Mental rehearsal in table tennis performance. *Perceptual and Motor Skills, 79*(1), 627-641. doi: 10.2466/pms.1994.79.1.627
- Olympics 2016 World Record News, Guinness World Records. (2016). Retrieved from <http://www.guinnessworldrecords.com/news/olympics-2016>

Taylor, J. A., & Shaw, D. F. (2002). The effects of outcome imagery on golf-putting

performance. *Journal of Sports Sciences*, 20(8), 607-613. doi:

10.1080/026404102320183167

Appendix A

Questionnaire

Subject Number (Filled in by researcher) _____

1 Have you ever played beer/water pong before? (please circle one) YES NO

2 If you answered NO to the above question, please skip to question 3. Please rate your beer/water pong skills on the scale provided below, with 1 being not very good and 9 being the best.

1 2 3 4 5 6 7 8 9

3 Do you play any sports competitively? (please circle one) YES NO

4 If you answered YES to the above question please indicate what sport(s) in the space provided below.

5 Have you ever received any formal training in any of the following areas? Relaxation, Visualization, and/or Body Rehearsal. If yes, please indicate which one(s), and the approximate number of hours spent training in the space below.
