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Arousal and Anxiety Level Influences on Golf Putting Performance

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Abstract

Arousal levels can help and hinder performance in various sports and many athletes manipulate arousal levels during practice or competitions. Professional golfers typically putt in complete silence but studies have shown that stimulus can help performance. Twelve participants completed general and sport anxiety questionnaires before completing 3 golf putts at a target under 30 seconds with a music stimulus for each group. Music stimulus had an affect on the moderate arousal level groups showing the best performance with the slowest time to complete the putting task. This shows that putting may be performed better with moderate auditory arousal to produce peak performance in competition atmospheres.

Arousal and Anxiety Level Influence on Golf Putting Performance

Anxiety is an emotional response that includes feelings of tension, nervousness, and worry that is linked with an increased activation of the sympathetic nervous system and affects many people in the US population. Anxiety disorders affect about 19% of the US population in 2017, with women being twice more likely than men to be affected (2017). Anxiety influences behavior, cognition, and performance in a variety of situations among most people. The sympathetic nervous system is part of the autonomic nervous system that stimulates a fight or flight response. This fight or flight response may cause anxiety for a person depending on the severity of response itself, but this sympathetic response often times has a negative impact on performance for tasks that may not require increased anxiety levels.

Anxiety responses differ per person in terms of overall anxiety and anxiety related to sport. This stimulation of the body in a negative way is considered somatic anxiety (Roberts, Hart, & Eastwood, 2016). The body feels these stressors and reacts to them, inducing increased heart rate, sweating, or blood pressure change. Behavior plays a role of trying to prevent these sensations from occurring by avoiding situations that may cause the stressor such as not going outside to avoid social interaction or wearing oversized clothes to cover the body to avoid judgment from others. In addition, cognition or cognitive anxiety can be defined as negative expectations and concerns about one's self, a situation, and possible consequences that may occur (Martens, Burton, Vealey, Bump, & Smith, 1990, p. 541). This is the negative thoughts that come with a situation that may be concerning for a person and possibly induce stress. Cognitive processes include worrying and concentration disruption. In addition, affects of anxiety on behavior and cognition can influence performance. Arousal level appears as a component of anxiety (Smith, Smoll, Cumming, & Grossbard, 2006). Anxiety and arousal can be

considered interchangeable. It can flood the brain with sympathetic nervous system stimulation. In some cases this may increase performance, and in others it may hinder performance based on the person and the situation the person is involved in (Hardy & Hutchinson, 2007). Performance anxiety can come from many different aspects of life such as different types of training in relation to game time play, cognitive thinking before time of play, or even a person's pre-performance routine (Hanton, Wadey, & Mellalieu, 2008). One arousal performance theory is the Inverted U Hypothesis. This is a theory on how moderate arousal is optimal for peak performance while low or high arousal hinders performance. It is thought that each person would perform the best at a "moderate" level (Yerkes & Dodson, 2007). The level of anxiety a person experiences will be not too high and not too low. This arousal is individualized per personal but still "moderate" to the individual. To counter this theory, there is the Individual Zones of Optimal Functioning theory. This theory claims that each individual person has a different level of arousal that produces his or her own peak performance (Hanin, 1997). This may not be moderate arousal but low or even high arousal. Arousal/anxiety may vary per person and is not a standard moderate level. One person's moderate arousal level could equate to another's low arousal level for example, but the individuals are not necessarily at moderate arousal. McMillan and Osterhouse (1972) found each group to have more high and low anxiety levels influencing the task performed by the participants. Participants who had low arousal showed to have better testing performance than those who had moderate or high arousal levels, but over all each person had different anxiety/arousal levels as a stimulus.

Arousal can be induced by many different variables, one of them being music. Music tempo and volume has been shown to affect heart rate, breathing rate, and blood pressure; and it can be used to affect arousal and relaxation (Bernardi, 2005). A study by Thompson,

Schellenberg, and Husain showed that classic Mozart music helps lower arousal in young adults (2001). Classical music is often used to calm babies when they are upset or cranky. Heavy metal, hard rock music that has a fast pace tempo has the opposite effect by in increasing heart rate, breathing rate, and blood pressure (Labbé, Schmidt, Babin, & Pharr, 2007).

The variables involved will be anxiety/arousal level in general life as well as in a sports atmosphere, training level for putting, perceived putting performance outcome, and time taken to complete three putts out of 30 seconds. Different arousal theories have been used to analyze sport arousal such as the Inverted U Hypothesis and the Individualized Zones of Optimal functioning (IZOF) and will be used as a guide for analysis of arousal in this study (Pineschi & Di Pietro, 2013). Although these two theories are being evaluated, there is not significant evidence that suggests any specific arousal theory is more influential as theories are continuing to be developed (Raedeke & Stein, 1994).

In summary, it is predicted that the IZOF theory is the accurate theory for this study. It is hypothesized that there will be a significant difference between the mean scores between the treatment music/arousal groups and control group; lower averages, meaning better performance, are predicted to be performed by the moderate-high anxiety group verses the none or low anxiety group. Also, the control group is predicted to take more time to complete the task due to lower arousal/ anxiety levels.

Method

Participants

The participant pool for the study is a convenience sample of students from Coastal Carolina University. Students range from being in their freshmen year to senior year, the average age being 23years old (±10.18), and were 75% females. The experiment opportunity will be

presented to student in the exercise science major to complete for extra credit by selected professors in the exercise science department at the university during his or her lecture periods. The lecturer will be requested to provide extra credit to students who participate in the study.

Procedure

Students will complete an informed consent form upon arrival. Paper questionnaires 1(Appendix A) and 2 (Appendix B) will be given to the students before they begin the experiment after completing the informed consent form. Each questionnaire will have a participant number. Once the questionnaires are completed, the examiner will collect them. The participants will be divided into an experiment group: treatment of "low to moderate arousal"(low-med) or "moderate to high arousal" (med-high), or the control group with "no arousal". The "moderate to high arousal" groups will receive the treatment of hearing loud, heavy, rock music during their assessment. The "low to moderate arousal" group will receive the treatment of hearing the same music but a lower volume during the assessment. The control group will perform the task with no music playing at all. All students will have 5 practice golf putts at a given target on an indoor putting green for "training" purposes. After the training, the assessment will consist of the students attempting three golf putts on the same green, after they completed the training putts. The examiner will turn on the music just as they are about to attempt their first assessment putts for the treatment groups. The participants will have 30 seconds to complete all three test putts, being notified when 20 and 10 seconds are left. Once the experiment is completed, the subject will fill out questionnaire 3 (Appendix 3). This questionnaire will be collected upon completion. All three questionnaires should take about five to ten minutes in total to complete. The debriefing statement will be given along with a form to hand into the professor from the class they were recruited from. This paper will notify the

professor the student completed the study and will provide extra credit as incentive. A comparison will be done between the three groups based on overall performance scores.

Measures

Task performance. The participants will putt one ball at a time on an indoor putting green with a universal golf putter (left handed and right handed putter). When the ball stops rolling, the examiner will replace the ball with a marker to mark the balls location from the hole while being able to move the ball out of the way for the following putt. Once this is done with all three putts, the length of the marker to the putting hole will be measured for distance, in inches, for each marker. The distance will measure the level of performance. An average of the three distances will be taken to have one average score per participant. Closer to the putting hole indicates better performance rather than farther away (lower scores are preferred). A follow up questionnaire (questionnaire 3) will be given asking why they feel they performed the way they did. This questionnaire is a sport success measure with a few random questions to determine the students' perceived influence of his or her performance (Duda & Nicholls, 1992).

Arousal. Participants will be experiencing different induced arousal levels based on their treatment group. Music level played during the task and the time constraint given will be the different arousal level or anxiety variables. Different music levels are intended to result in different anxiety and arousal responses that may affect performance outcomes (Hirokawa, 2004). Time constraint is intended to induce more performance pressure (Wirth &Carbon, 2017).

Anxiety. Anxiety measures will be evaluated in two ways. First, sport anxiety will be measured to assess the anxiety level in athletic performance. A sport anxiety scale questionnaire (questionnaire 1) will be used to evaluate this measure consisting of 15 questions will be used that measures somatic arousal, worry, and concentration disruption, Cronbach's $\alpha = .902$ (Smith,

Smoll, Cumming, & Grossbard, 2006). Students will agree or disagree with the statements given on the survey in relation to how they feel under sport pressure (1= Not at all, 4 = Very much so). The second anxiety measure will be general anxiety to evaluate the over all general anxiety a person has on a day-to-day basis. The State-Trait Inventory for Cognitive and Somatic Anxiety questionnaire (questionnaire 2) will be used to measure this variable and be will answered preceding the sport anxiety scale, Cronbach's α= .87 (Ree, French, MacLeod, & Locke, 2008). Students will answer 21 questions the same way by agreeing or disagreeing with the statements given (1= Not at all, 4 = Very much so). Higher scores will indicate high anxiety (max score = 144) while low scores indicate low anxiety or none at all (lowest score = 36). A correlation analysis will evaluate the variables, as done so in a study by Madrigal, Roma, Caze, Maerlender, and Hope (2018). The correlation will be between general and sport anxiety, sport anxiety and performance outcomes, and general anxiety and performance outcomes. Another correlation will be done between treatment group and time to complete the task. In addition to the questionnaires, demographics such as age, sex, and performance pressure experience will be collected. An indoor putting green with a putter and a golf ball will be used to complete the physical experiment.

Results

For each participant, age, sex class year, sport anxiety score, general anxiety score, total time to complete the task, and average putting score were collected. Five practice putts were given to each person and then three putts were performance for analysis. Four questions from the post questionnaire were reviewed that pertained to the study.

We compared total scores for general anxiety questionnaire and sport anxiety questionnaire to determine if the two different types of anxiety are correlated. The mean for the

general anxiety questionnaire is 40.75(±9.37), Kruskal Wallis H(2)=.038, p=.981 (Figure 1). The mean for the sport anxiety questionnaire is 32.33(±7.99), Kruskal Wallis H(2)=.03, p=.985 (Figure 2). Parametric tests also suggested that anxiety levels were similar between groups. General anxiety among groups showed similar, F(2,11)=.228, p=.801, as well as sport anxiety among groups, F(2,11)=.020, p=.980. Over all, general and sport anxiety did not have an affect prior to the study indicating anxiety was uniform for each group.

We compared the total time to complete the task among control, low-med volume, and med-high volume groups. Mean and standard deviation values are reported in table 1. Total time to complete the task was significantly different among groups, F(2,11)=4.34, p= .048. The low-med group had a marginally significantly higher time to complete the task than the med-high volume group, Tukey HSD p=.051.

Average putting score was compared among the control group, low-med volume group, and med-high volume group. Mean and standard deviation scores are reported in table 2. Average putting score was significantly different among groups, F(2,11)=7.33, p=.013. The low-med group was significantly different from the control and med-high groups, Tukey HSD p<.05 for both comparisons.

The third questionnaire was analyzed for the percent of participants agreeing with questions to determine if their perception of success. Seventy five percent of participants agree "they feel that they have the right clothes and equipment" will affect success, all participants agree that "they feel they can concentrate" will affect performance, 58.33% agree " they feel as though there was a lot of pressure to perform well" affected performance, and 83.33% agree "they feel they have enough practice" will affect performance.

Discussion

We used two questionnaires to evaluate college students' sport and general anxiety among three groups: control, low-med, med-high. Questionnaire One assessed sport anxiety levels in the participants and indicated an overall moderate anxiety across groups. The second questionnaire assessed general anxiety levels in everyday life indicated moderate anxiety across groups. A putting task was used to evaluate performance under pressure using different music volumes per each group. Results are consistent with studies that showed a relation between arousal and sport performance, but not with studies that show no relation between arousal and sport performance.

The general and sport anxiety questionnaires were given at the beginning of the experiment because anxiety level was intended to be standard. Before the participants were assigned groups, they took questionnaires 1 and 2. There was no significant difference between groups for general and sport anxiety, showing that each person's anxiety/arousal levels prior to the study had no influence on their task performance. This provided a baseline for the study, allowing the music arousal level to be the influencer, or the independent variable. The questionnaires helped to reduce potential confounds in the study.

Arousal levels can have influence on sport task performance, including golf putting. A study by Yerkes and Dodson (2007) explains the Inverted U hypothesis. Arousal level will produce peak performance if arousal is moderate. Low arousal is not enough while high arousal is too much to allow for peak performance (Yerkes & Dodson, 2007). In this study, mice maneuvered their way through a box with electrical stimuli as arousal. To little or to high stimulus did not direct mice in the correct direction, while moderate stimulus motivated the mice to achieve the directed goal of escaping the box. A study by Hanin (1997) counters the findings of Yerkes and Dodson. Hanin found that individuals have their own peak performance levels

rather than a moderate level working best for everyone (Hanin, 1997). This explains the IZOF theory. This study measured human general anxiety with scales and how that interacted with modalities of performance such as content, intensity, context, and time of anxiety present. This allowed him to analyze each person individually to give a different perspective on arousal/anxiety level influence on a task. Our study supports the Inverted U hypothesis due to the low-med, or moderate, arousal group showing better performance on the putting task. Type of arousal could be influencing this finding. Our study used music volume as a stimulant while Yerkes and Dodson used electric shock. Hanin did not manipulate arousal at all. Instead, he used what naturally stimulates each participant based on surveys.

Arousal level can also influence how long it takes to complete a sporting task, including a golf putt. A study by Doyle, Lutz, Pellegrino, Sanders, and Arent (2016) found that moderate arousal levels, stimulated by caffeine, induced a faster reaction time to a fencing task. Participants were to drink a certain amount of caffeine depending on the group they are in. Then, they completed a fencing target task, hitting fencing targets under time pressure. Participants were able to hit a fencing target quickest with moderate to high arousal levels. Similarly, Schneider and colleagues (2006) found that using caffeine as a stimulus to arouse the participants increased task completion time. Participants were given a reaction time test, Test Battery for Attention Performance, to measure performance times before and after drinking caffeine. The task was to look at a screen 60m away and click a button in hand when certain images were presented. Half the participants drank caffeine and the other half thought they drank caffeine but actually receive a placebo. Those who drank caffeine performed faster than those who did not drink caffeine. Our time on the putting task shows the moderate arousal group producing the longest times to complete the putting task than those in the high arousal or no arousal group,

which differs from what we predicted. We predicted the control group to take the longest time to complete the task. Although our findings suggest that slow times help performance rather than fast, finding still aligns with previous studies, saying that arousal level will influence time and performance.

Our study had a few limitations. One limitation was the overall number of participants. A significant affect could have been found in other areas of the study than just the low-med group's time and putting score. More participants allow for larger sample size, therefore more practical comparison to the population. Another limitation was that our sample included primarily females. Females typically have higher anxiety levels than males due which could have influenced how the music volume affected their performance more than males. For later research, they study should consider have sex be uniform across the study or having even male and female participants in each group in order to avoid a sex confound. To add, a small speak for music volume was used for the study. A bigger speaker or a surround system speaker could more effectively manipulate music volume and the influence it had on arousal level. Incentive to participate was given for the students who chose to participate. This may have altered the student's attitude about the study or the perceived seriousness of the study.

Knowing the appropriate arousal and anxiety level for sport performance and how daily and sport anxiety plays a role in an athlete's performance is important for performers to reach their peak level. Specifically, professional golfers typically putt in silence. This study suggests that some sort of moderate arousal will help produce the desired performance that the golfers strive for. There are different way that people can achieve this arousal whether it is an auditory stimulus or and internal stimulus. Athletes should consider the arousal levels influence on their performance for future completion in order to perform optimally.

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Table 1

Mean and standard deviation values for total time to complete putting task for control group, low-med volume group, and med-high volume group.

	Mean (sec)	Standard deviation
Control (4)	21.268	3.367
Low-Med (4)	22.668	5.111
Med-High (4)	15.570	1.207

Table 2

Mean and standard deviation values for putting score averages for control group, low-med group, and med-high group.

	Mean (inches)	Standard deviation
Control (4)	42.69	8.28
Low-Med (4)	24.25	8.59
Med-High (4)	46.63	9.56

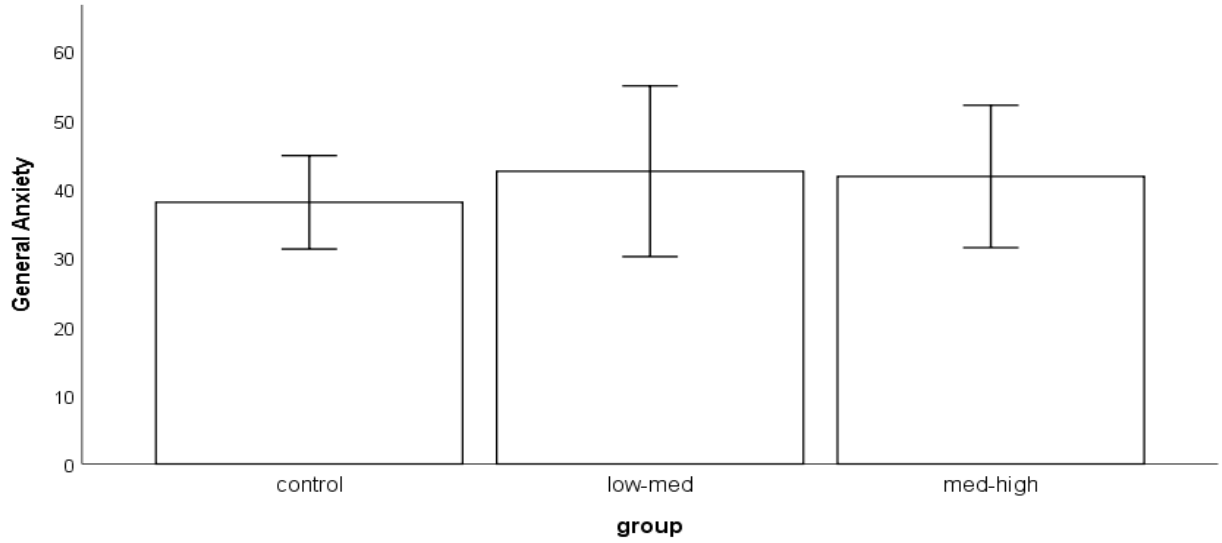

Figure 1. Mean scores for control, low-med, and med-high groups on the general anxiety scale with standard deviations.

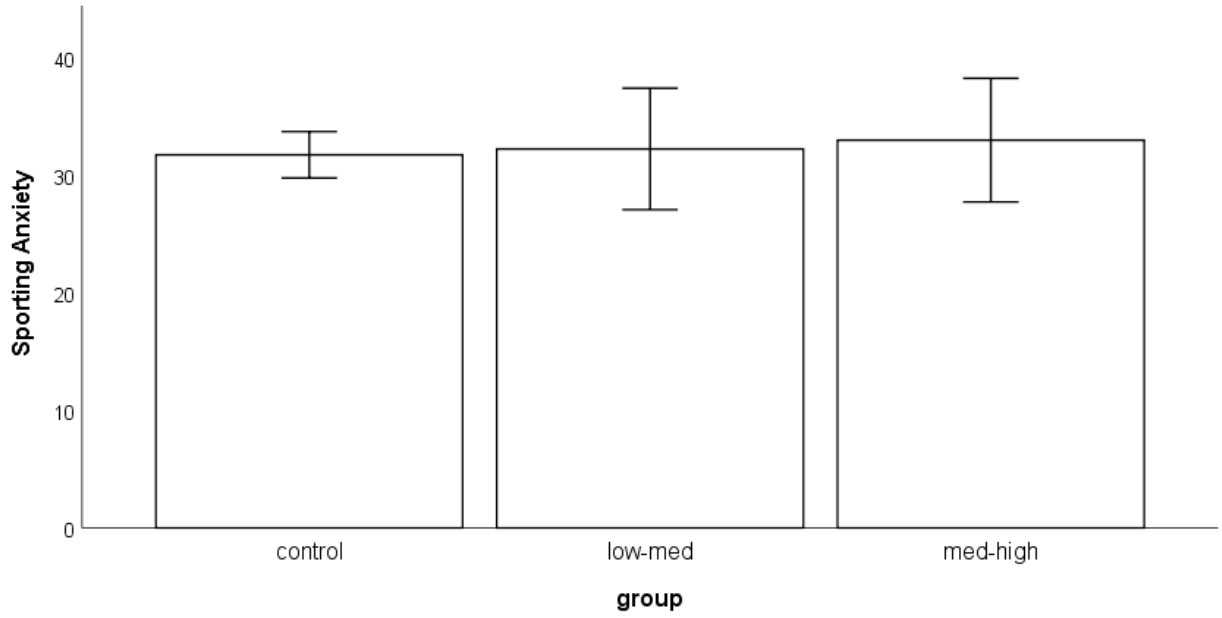

Figure 2. Mean scores for control, low-med, and med-high groups on the sport anxiety scale with standard deviations

Appendix A

Sport Anxiety and General Survey

This survey is designed to evaluate your general anxiety level during your everyday life and your anxiety level in the sporting environment. Your participation is completely voluntary and you are free to withdraw at any time. All data are strictly confidential and no names will be associated with the data.

Please indicate:

Age_____ Sex_____ Class year_____

Do you have performance pressure experience?_____

Questionnaire 1	Not at all	A little	Moderate	Very much so
1. It's hard to concentrate on the game.	1	2	3	4
2. My body feels tense.	1	2	3	4
3. I worry that I won't play well.	1	2	3	4
4. It is hard for me to focus on what I am supposed to do.	1	2	3	4
5. I worry that I will let down others.	1	2	3	4
6. I feel tense in my stomach.	1	2	3	4
7. I lose focus on the game.	1	2	3	4
8. I worry that I will not play my best.	1	2	3	4
9. I worry that I will play badly.	1	2	3	4
10. My muscles feel shaky.	1	2	3	4
11. I worry that I will mess up during the game.	1	2	3	4
12. My stomach feels upset.	1	2	3	4
13. I cannot think clearly during the game.	1	2	3	4
14. My muscles feel tight because I am nervous.	1	2	3	4
15. I have a hard time focusing on what my coach tell me to do.	1	2	3	4

Appendix B

Questionnaire 2	Not at all	A little	Moderately	Very much so
1. My heart beats fast.	1	2	3	4
2. My muscles are tense.	1	2	3	4
3. I feel agonized over my problems.	1	2	3	4
4. I think that others won't approve of me.	1	2	3	4
5. I feel like I'm missing out on things because I can't make up my mind soon.	1	2	3	4
6. I feel dizzy.	1	2	3	4
7. My muscles feel weak.	1	2	3	4
8. I feel trembly and shaky	1	2	3	4
9. I picture some future misfortune	1	2	3	4
10. I can't get some thought out of my head	1	2	3	4
11. I have trouble remembering things.	1	2	3	4
12. My face feels hot.	1	2	3	4
13. I think that the worst will happen.	1	2	3	4
14. My arms and legs fell stiff.	1	2	3	4
15. My throat feels dry.	1	2	3	4
16. I keep busy to avoid uncomfortable thoughts.	1	2	3	4
17. I cannot concentrate without irrelevant thoughts intruding.	1	2	3	4
18. My breathing is fast and shallow.	1	2	3	4

19. I worry that I cannot control my thoughts as well as I would like to.	1	2	3	4
20. I have butterflies in the stomach.	1	2	3	4
21. My palms feel clammy.	1	2	3	4

Appendix C

Post study: Questionnaire 3

People succeed if:….	Agree	Disagree
They like improving.		
They always do their best.		
They work really hard.		
They like to practice.		
They help each other learn.		
They like to learn new skills.		
They try things they can't do.		
They pretend they like the coach.		
They know how to impress the coach.		
They know how to cheat.		
They know how to make themselves look better than they are.		
They are better than others t tough competition.		
They are better athletes than the others.		
They always try to beat others.		
They are born natural athletes.		
They feel they have the right clothes and equipment.		
They feel they can concentrate.		
They are just lucky.		

Coaches think they will do well.		
They feel as though there was a lot of pressure to perform well.		
They feel they have enough practice.		