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Golf Brain: A Neuropsychological Study of Performance in Competition

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by

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Abstract

Golf, as a sport, has been described by its masters as a mental game first and a technical skill second. Many players logged countless practice hours only to find suboptimal performance in tournaments; when it matters the most. I investigated the relationship between executive functioning specific to decision-making under anxious arousal and golfers' performance under anxious arousal. I used a repeated measures design including variety of executive functioning tests to examine participants' abilities. Participants were recruited from western Oregon including collegiate golfers and university students, and were grouped into non-golfers and golfer groups based on whether they played golf and self-reported a consistent ability to score below 80 on a golf course. A golf performance putting task that mimics tournament pressure, "Tornado task," was the initial task. Heartrate and skin conductance data were gathered during the Tornado task and executive functioning tasks. Results showed differences between golfer and non-golfers in their physiological arousal during risk-reward decisions. The IGT-2, Color-Word, and Tower Test executive functioning measures yielded similar arousal levels between groups. Self-reported anxiety on performance did not equate with greater physiological arousal during executive functioning tasks. RMSSD appears to be a more accurate measure of physiological arousal under pressure than EDA. It is likely that golfers have more training in managing sympathetic arousal in competition, are more accustomed to risk reward situations, and take greater risks in the presence of physiological arousal. I found golfers experience less anxious arousal while taking executive functioning tasks, and take more risks in decision-making decisions yet do not outperform non-golfers. Golfers were able to manage their nervous system arousal more effectively than non-golfers.

Keywords: Golf, Neuropsychology, Brain, Putting, Performance, Executive Functioning,

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Chapter 1

Introduction

Decision-Making

Decision-making can become particularly difficult when experiencing various arousal states (Gambetti & Giusberti, 2012). Experiencing anxiety can lead to overly conservative choices that are non-beneficial (Gambetti & Giusberti). Experiencing anger can lead to increased risk-taking behavior in decision-making (Gambetti & Giusberti). The potential consequences of poor decision making under sub-optimal arousal states are varied. For example, in golf, a pre-performance routine (PPR) can improve player performance, and is recommended in preparation for performance (Lei et al., 2016). Lei et al. found anxiety can decrease the consistency of the PPR and lead to poorer performance.

Decision-making is a deliberative process. Information is collected, alternatives considered, and costs and benefits are analyzed, and evaluated for the completed action (Suchy, 2016). Each of these processes is monitored and maintained by the executive functioning system of the brain.

Executive functioning describes neurocognitive processes involved in the planning, selection, and execution of actions that are purposeful and adaptive, goal-directed, and future-oriented (Suchy, 2016). Reynolds and Horton (2006) included performing adaptive actions and generating novel motor outputs adapted to external demands. Suchy (2016) argues that executive functioning provides humans an evolutionary advantage by overriding unhelpful reflexes and the stimulus-response seen in other species. As these processes are maintained, we can make informed decisions about the world.

Brain Areas Associated with Decision-Making

Decision-making has long been linked to specific areas in the brain (Demasio, 2005). Posner (as cited in Goldstein & Naglieri, 2014) first proposed a separate executive branch of the attentional system responsible for providing selective attention leading to decision-making. While executive functioning is associated with specific brain regions such as the prefrontal cortex, they are not a centrally located series of processes (Goldstein & Naglieri). Demasio (2005) described a series of brain regions, including the prefrontal cortex, hypothalamus, and brainstem, as working together in creating reasoning skills (Demasio). However, research shows the interconnectedness of the decision-making processes within brain networks outside of the prefrontal cortex. These networks include the cerebral cortex's anterior and posterior regions and show the intricacy of these processes observed through brain imaging (Goldstein & Naglieri).

Randolph (2013) described the ventromedial prefrontal cortex as appearing to play a critical role in "evaluating personal and social consequences of a decision and whether a decision is in one's best interest" (p. 111). Damage to the ventromedial prefrontal cortex has been shown to result in difficulty coding negative consequences impacting learning from such experiences for future actions (Suchy, 2016). The performance/error-monitoring system has been located in the medial prefrontal cortex, including the anterior cingulate gyrus and supplementary motor area, and is crucial in making decisions and learning from trial and error (Ridderinkhof et al., 2004).

Decision-making also entails making conscious choices. Bateman & Kaufer (2018) suggested the dorsolateral prefrontal cortex helps balance past events, and plan current actions while programming motor acts in response to the choice being made, implementing programs to achieve the intended goal. Finally, the dorsolateral prefrontal cortex helps monitor the results of the action and weigh the costs and benefits of the action on the outcome (Miller & Cummings, 2018).

Types of Anxiety

Two types of anxiety are specific to this study. Trait anxiety is defined as the level of individuals' proneness to experience symptoms of anxiety (Morales, 2012). Anxious arousal is a physiological autonomic nervous system response to anticipation of an uncertain outcome in an event (Stapinski et al., 2010). It is expected before performing important tasks, with most golfers experiencing either excitement or anxious arousal before a golf round (pre-performance) (Brooks & Gauthier, 2014). This anxious arousal decreases an individual's working memory capacity, self-confidence, and performance (Brooks & Gauthier). The difficulty with pre-performance anxiety is that the arousal level mimics excitement physiologically (Brooks & Gauthier). The similarities between excitement and pre-performance anxiety pose a problem for golfers' tournament performance when they are excited to compete and experience pre-performance anxiety (Brooks & Gauthier). While arousal can enhance performance by increasing preparation for tournaments, high levels of anxiety shortly before or during performance tasks typically have harmful effects on the players' performance and cognition (Brooks & Gauthier). With most golfers experiencing either excitement or anxiety before a round and others experiencing higher proneness to anxiety during a round (trait anxiety), it remains unclear the differences between golfers who succeed under these conditions and those who falter.

Decision-Making Amidst Distractors and Anxious Arousal

Physiological arousal impacts decision-making and has many beneficial qualities alongside some drawbacks. Physiological arousal can be quickly tied to memory to maintain our safety in the world. This "feeling memory" offers flexible response options depending on experiences within an environment (Demasio, 2005). Harlé et al. (2017) found significant variability among individuals, including anxiety levels, reward-based, and exploratory decision-making. This suggested a nuanced relationship between various experiences of anxiety in relationship with decision-making task performance.

Anxiety has the potential to be a hindrance when weighing competing options and moving confidently towards a decision. Snyder et al. (2013) found that anxiety was associated with a robust and specific impairment in decision-making on tasks, including competing options. In contrast, anxiety can increase sensitivity to and expectations of adverse outcomes, including loss, punishments, and errors in decision-making situations (Harlé et al., 2017). Performance anxiety can lead to performance errors (Masaki et al., 2017).

Decision-Making in Sports

Causer and Ford (2014) examined whether successful decision-making is specific to a sport or transfers between related and similar elements. This relates to whether decision-making in sports is a single skill that is generalizable to other sports or a specific skill explicitly developed to the mastered sport. Causer and Ford evaluated sporting groups of soccer, invasion sports (needing a team to score points), and individual sports such as golf or tennis using a soccer-specific decision task. They found a positive transfer of decision-making skills between players switching from one sport to another if they had similar elements. Implicated in this study is a general skill of decision-making in sports that is increased when the new sport shares similarities to the mastered sport (Causer & Ford, 2014).

Decisions and Golf

As a sport, golf has been described by its masters as a mental game first and a technical skill second (Grant, 2014). Within this "mental game," decision-making is crucial for optimal performance in competitive golf. Performance responsibility falls on a single player. During a round of golf, players must mentally hold complex variables simultaneously for four to five hours, including calculated decisions about distance, slope, wind direction, temperature, and risk-reward. Once the shot decision is made, skilled players must manage their thinking, anxiety, and calculating to execute a swing movement to achieve the desired result. This occurs between 60-100 times each round for each player (Preston, 2020).

While golfers consider many factors during their round, many distractors occur as well. Optimal performance in golf depends on mental and emotional control (Swann et al., 2012). The game's slow pace allows the potential for overthinking, distraction, anxiety, fear of failure, and ironic processes of cognition where a player hits a shot in a direction they tried to avoid (Swann et al., 2012). Specifically, golfers experience anxious arousal on the first few shots of their round. "First tee jitters" is a well-known phenomenon in the golf community that may or may not hinder players from performing at their optimal level resulting in sweaty palms, stomach tension, and muscle tension similar to arousal observed in autonomic responses measured by Electrodermal Activity (EDA; Critchley, 2002). Some highly-skilled golfers cannot perform at an optimal level while experiencing such arousal and find themselves making scores outside of their typical scoring average. In contrast, others seem un-phased by this anxious response and may even improve their performance under such conditions (Dias & Couceiro, 2015).

Along with anxious arousal, golfers experience numerous distractors during their round. Appropriate decision-making amidst distractors is crucial to maintaining the desired level of performance.

Brain Areas Related to Golf

Golf requires multiple brain functions including attention, motor planning, coordination, calculation of timing, and emotional control (Sommer & Ronnqvist, 2009). Participating in such a rigorous sport correlates with changes in the brain found Pro-golfers exhibited more positive left cerebellum all other lobes including frontal lobes compared to controls (Kim et al., 2015). Bezzola et al. (2011) examined training-induced gray matter changes in adult golf novices. They found that golf played both leisurely and practiced with highly individual training protocols are "associated with gray matter increases in a task-relevant cortical network encompassing sensorimotor regions and areas belonging to the dorsal stream" (p. 12444). This research provides potential clues into the influence golf performance may have on golfers' brain structure and subsequent function.

Effects of Anxiety in Golfers' Brain Areas

The experience of anxiety before and during athletic competitions can result in poor athletic performance (Schaefer et al., 2016). While moderate anxiety can lead to improved sports performance, Craft et al. (2003) described anxiety-provoking circumstances as leading some athletes to experience performance deficits. This was most relevant to golfers due to the lack of social support, a coach or teammate intervention, to reduce the pressure in a situation (Craft et al.). Golf requires precise movement incorporating gross and fine motor skills along with decision-making, including the mathematic judgment of distance, wind, and slope. Nieuwenhuys and Oudejans (2017) highlight "high levels of anxiety induce changes in attention that make it more difficult to focus on task-relevant information and efficiently coordinate movement, thereby often causing decreases in performance" (p. 28). Based on these findings, it is clear that anxiety can reduce a golfer's performance; however, it is unclear whether this is generalizable to all highly skilled golfers.

Heart Rate Variability and Executive Functioning

Hovland et al. (2012) explored the relationship between heart rate variability (HRV) and executive functioning (EF) with individuals with panic disorder, Standardized EF scores on the Wisconsin Card sorting task measuring cognitive flexibility, cognitive switching, and inhibition were correlated with high HRV (Hovland et al.). The study noted no association between HRV and the Switching task. Hovland et al. concluded that their results "provided support for the associations between EF related to the PFC and cardiac control via the vagus nerve" (p. 272).

Limitations in Research and Current Study

Limited research has been conducted on the relationship between golfers' decision-making ability and competition performance under pressure (Verburgh et al., 2014). I examined the role anxiety plays on executive functioning with highly skilled golfers' decision-making and relationship to the level of performance under pressure. I explored the differences between highly-skilled golfers experiencing anxious arousal who perform well and non-golfers (due to COVID-19 the original plan to compare with highly skilled golfers who perform poorly under anxious arousal had to be changed).

I used a 2-group design. My independent variable was the golfers' skill levels (two groups) and non-golfers (controls). My dependent variables included EDA means, RMSSD, self-report measure scores, and scores on selected neuropsychological tests measuring executive functioning.

Hypotheses

EDA Hypotheses

Based on the research showing differences in performance in individuals experiencing higher levels of anxious arousal compared with lower anxious arousal groups, I hypothesized that (a) the physiological measures (EDA) obtained during the high-risk skills test, "Tornado Task," and during the neuropsychological testing (selected DKEFS subtests2) would show differences between golfers and non-golfers (Gambetti & Giusberti, 2012; Snyder et al., 2013). On the putting task, I hypothesized, (b) non-golfers would have higher EDA than golfers.). Additionally, I hypothesized, (c) there would be a lower pulse rate for golfers than non-golfers during the putting task. I hypothesized the non-golfers would not show differences in EDA from golfers due to their lack of experience or expectations within the sport golf (Brooks & Gauthier, 2014). Differences found within this group should be attributed to the participant being more competitive than their peers. Finally, I believed (d) participants scoring higher on the SAS in trait anxiety would show higher EDA (anxious arousal) regardless of skill level (Critchley, 2002; Morales, 2012).

EF Score Hypotheses

I hypothesized that this increased connectivity would result in differences between golfers and non-golfers in their visuospatial planning, rule learning, and inhibition on the Tower Test and inhibition and cognitive flexibility during the Color-word Interference task (Strauss et al., 2006). I hypothesized there would be mean differences within the DKEFS-Tower test between golfers and non-golfers as a reflection of visuospatial processing ability during a timed task, with golfers taking more time to complete the task accurately. I believed golfers would have a higher mean time on the Tower Test than non-golfers due to an increased ability to make deliberate and informed choices despite anxious arousal when processing visuospatial information. I expected higher EDA scores and higher pulse rates for non-golfers than golfers during the DKEFS EF tasks (Gambetti & Giusberti, 2012).

HRV Hypotheses

I hypothesized that golfers would outperform non-golfers on IGT-2 tasks indicating an increased ability to make decisions amidst distractors and impulse control in response to loss (Ridderinkhof et al., 2004; Harlé et al., 2017) I expected non-golfers to show higher EDA scores than golfers during the IGT-2 task and lower RMSSD (increased sympathetic arousal). I expected each group to show higher EDA scores on the IGT2 than the DKEFS-Tower test, Color-Word Interference Test, and Trail Making Task Part B (Strauss et al., 2006). Finally, I expected similar EDA scores for each group on the IGT-2 compared with EDA scores on the "tornado" task (Bechara, 2007).

Chapter 2

Methods

Participants

This study recruited 11 participants in western Oregon. Data collection began in February 2020 and was quickly halted by the COVID-19 pandemic. Due to social distancing restraints, only two self-reported golfers were included in the sample and nine were non-golfers. Participants were selected through undergraduate courses, graduate programs, university golf teams, and local golf facilities and organizations. Participants were told they were competing against fellow participants for a $100 gift card. The student athletes included in the study were told they were ineligible for the $100 gift card due to NCAA restrictions.

The age range of participants was 21-30 years (M = 25), with an even distribution of men and women, both golfers were men. The participants were predominantly White (n = 1 Asian/Pacific Islander). Each participant reported right handedness. Socio-economic status ranged from lower-middle to upper middle class (LM n = 2; M n = 4; UM n = 5). The sample education achievement ranged from bachelor's degree to some-graduate school (B n = 2: M n = 3; SC n = 2; Grad n = 4).

Five participants actively participated in meditation practices. Five self-reported experience of brain injury (see Appendix A). This study was approved by the Institutional Review Board (IRB) at George Fox University.

Materials

Sport Anxiety Scale-2 (SAS-2)

The Sport Anxiety Scale-2 (SAS-2) is "a multidimensional measure of cognitive and somatic trait anxiety in sport performance settings" (Smith et al., 2006, p. 479). The SAS factor structure separates performance anxiety into 5-item subscales for Somatic Anxiety, Worry, and Concentration Disruption improving the factorial validity from the SAS-I (Smith et al.). The SAS-2 Total score alpha coefficients exceeded .89 for all age groups indicating a reliable measure of performance anxiety (Smith et al., 2006) (see Appendix C).

Golf Self-Efficacy Scale (GSES)

The Golf Self-Efficacy Scale is a 12-item self-report measure assessing a golfer's ability in key skills and behaviors associated with being a successful golfer (Hayslip et al., 2010) (see Appendix B). The measure was found to possess high internal consistency, and correlate with each of the four predicted competitive golf tournament scores (Hayslip et al.). GSES scores were also reliably related to competitive anxiety (r = -0.45, $p < .01$), generalized self-efficacy (r = 0.30, $p < .01$), and pre-round anxiety (r = -0.26, $p < .01$; Hayslip et al.). These findings suggest the GSES to be a reliable and valid measure for use within research contexts with amateur golfers (Hayslip et al.).

Delis Kaplan Executive Function System

The DKEFS is a battery used to measure executive functioning in individuals aged 8-89 (Delis et al., 2001). It contains nine standalone subtests designed to comprehensively assess the important functions associated with the executive functioning system.

DKEF-S Tower Test

The DKEF-S Tower test involves moving five disks across three pegs to build tower design in the fewest moves possible (Strauss et al., 2006, p. 444). Strauss, et al. describe this task examining a participant's planning, rule learning and inhibition. The correlation between the half tests was corrected using the Spearman-Brown formula to derive the internal consistency coefficients. The 16- to19-year-old age group yielded total achievement values of .6 and .62 for the 20-29 age group. Internal consistency increase to .72 in the 30- to 49-year-old age group. The tests' retest reliability coefficients for all ages showed an *r* of .44 with first test scores showing a mean of 10.35, *SD* = 3.21 and second test scores showing a mean of 11.66 and *SD* = 2.94.

DKEF-S Color-Word Interference Test

The Color Word Interference Task, a variant of the Stroop Task, studies a participant's inhibition and flexibility during an unlearned response through four test conditions (Strauss, et al, 2006, p. 444). Internal consistency and test-retest reliability were examined. Internal consistency values ranged from 0.62-0.86 based on age (Delis, et al., 2001). Strauss, et al. (2006) reported internal consistency was in the adequate range (.70-.79). Test-retest reliability showed the improvement between test one and two with correlation values falling in the moderate to high range indicating a reliable test profile for use in research settings.

DKEF-S Trail Making Task Part B

The Trail Making Task Part B is a measure of flexibility of thinking consisting of five conditions (Delis, et al., 2001). (see Appendix D). It assesses visual scanning, number sequencing, letter sequencing, number-letter switching, and motor speed (Strauss, et al. 2006). Internal consistency on the Trail Making task fell within the adequate range (.70-.79) indicating a reliable test profile for use in research settings.

Iowa Gambling Task-Second Edition (IGT-2)

The IGT-2 is a computerized test used in the evaluation of decision making. The examinees are evaluated on their ability to select advantageous and disadvantageous cards from four decks. This task is designed for use with individuals who exhibit poor decision making in the presence of typical intelligence because of head injury or prefrontal cortex functional difficulties (Bechara, 2007). The IGT-2 has been shown to be a highly sensitive measure of impaired decision making in a variety of neurological and psychiatric conditions for individuals. When compared with similar tests from the Psychology Experiment Building Language (PEBL) test battery, the Iowa Gambling Task "the PARIGT and the PEBLIGTs showed a very similar pattern for response times across blocks, development of preference for Advantageous over Disadvantageous Decks, and Deck selections") supporting the criterion validity of the IGT when measuring decision making and attention tasks (Piper et al., 2016, p. 1).

"Tornado" Task

Participants were asked to complete a "tornado" putting task where the player must make 5 consecutive putts starting from 3 feet from the hole and increasing by 1-foot increments until putting the final putt from 8 feet from the hole (Schinke & Hackfort, 2017). If the players miss any putt they returned to the starting point and work their way back to the 8-foot endpoint (Schinke & Hackfort). Schinke & Hackfort found the "tornado" task to be "particularly useful…in respect to the performance cycle- Preparation, Execution, Reaction, Regeneration, as well as mental tools such as goals, self-talk, breathing, and mental rehearsal" (p.109).

Biopac Electrodermal Activity (EDA)

A mobile Biopac MP160 Electrodermal Activity (EDA) and PPG (pulse) system (PPGED-2) was used to measure participant arousal levels throughout executive functioning testing. It is often used as a physiological measure of anxious arousal showing good repeatability and reliability (Critchley, 2002). EDA is also a “useful indicator of attention, and it is widely recognized that attention grabbing stimuli and attentionally demanding tasks evoke increased EDA responses” (Critchley, 2002, p.134).

Procedure

Participants received the testing at their respective universities in a quiet assessment room to reduce external distractors with a putting mat provided by the researcher to ensure consistency of the putting task. Participants were encouraged to bring their personal golf club (putter); however, putters were provided at the facility if they chose.

Testing Process

Participants arrived at the testing facilities and informed consent was collected alongside self-report measures. Participants were moved to the putting task room and were connected to EDA and PPG. The researcher informed the participant of the task and instructed them to take each shot (15 sec. intervals). The participants were informed they may or may not be filmed during the putting task to increase anxious arousal and provide performance feedback, with the video being deleted after the participant received feedback on putting performance. After the putting exercise, participants moved to a testing desk where they were administered the DKEFS subtests by a competent psychometrician. At the end of the DKEFS subtests, participants) transitioned to a laptop computer where they completed the IGT-2. Participants were informed by email if they won the gift card.

Chapter 3

Results

Descriptive Statistics

An independent samples *t*-test was performed looking at differences between genders on SAS domain scores. No significant differences were found for the SAS scores: Worry ($t(9) = .160$, $p = .877$), Concentration Disruption ($t(9) = .185$, $p = .857$), or Somatic ($t(9) = .589$, $p = .570$). Therefore, I determined it appropriate to combine genders for the analyses.

Six of my participants listed having a head injury. I evaluated SAS total score based upon the history of a head injury. No significant difference in anxiety as measured by the SAS occurred between participants with and without a head injury, ($t(9) = .907$, $p = .388$), thus combining them into one group for the analyses is appropriate.

COVID Affects

Due to COVID the last four participants were evaluated after COVID lockdown. Thus, the baseline for EDA was looking at a blank page rather than the "rest" that occurred while instruction was occurring. The baseline EDA was significantly correlated with the pre-COVID Rest, relaxed putting EDA mean and the 1st attempt putting EDA mean, indicating that the baseline blank page was an appropriate measure of their typical EDA ($r^2(n = 4) = .966$, $p = .034$). The last four participants were combined with the pre-COVID participants.

EDA Hypotheses

SAS and EDA

The hypothesis that participants scoring higher on the SAS in trait anxiety will show higher EDA (anxious arousal) regardless of skill level was not supported (see Table 1).

Table 1

SAS and EDA 1st Attempt 1Mean

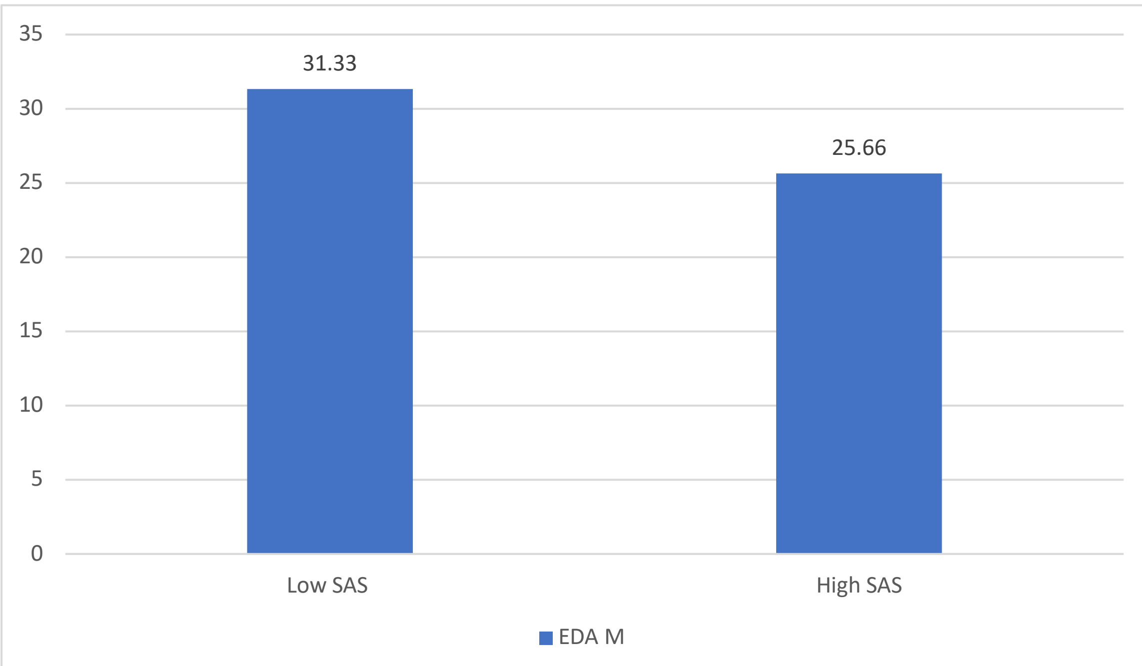
		SAS Total	SAS Worry Score	SAS Concentration Disruption	SAS Somatic	EDA 1st Attempt T 1Mean
SAS total	Pearson Correlation	--				
	N	11				
SAS Worry Score	Pearson Correlation	.821**				
	Sig. (2-tailed)	.002				
	N	11	11			
SAS Concentration Disruption	Pearson Correlation	.643*	.123			
	Sig. (2-tailed)	.033	.719			
	N	11	11	11		
SAS Somatic	Pearson Correlation	.976**	.803**	.582		
	Sig. (2-tailed)	.000	.003	.061		
	N	11	11	11	11	
EDA 1st Attempt T 1 Mean	Pearson Correlation	-.199	-.042	-.129	-.293	
	Sig. (2-tailed)	.582	.908	.722	.411	
	N	10	10	10	10	10

Note. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

In order to simulate "first trial jitters," I used SAS scores to have two "anxiety" groups (split at the medium of 26). Using the mean of the full group for the total SAS score, those above the mean were put in the High group, those below the mean were in the Low group. A *t*-test was used to analyze EDA differences between higher and lower SAS total scores groups. There was no significant difference in the EDA M between high and low SAS total score groups, $t(8) = .830$, $p = .430$, Cohen's $d = .525$, although the effect size is moderate indicating that the anxiety score may contribute to "first tee jitters." This portion of the hypothesis was not supported due to the difference being in the reverse direction from what was expected (see Figure 1).

Figure 1

EDA Means Between High and Low Sports Anxiety Scores



Note. This figure demonstrates the EDA means for those with low anxiety and those with high anxiety as reported through the SAS.

SAS Groups and Executive Functioning

Looking at the high and low SAS groups, I analyzed the effects of anxiety on executive functioning test scores. Beginning with visual tasks, a MANOVA was used to evaluate Trail

Making test (Conditions 1-5) between the high and low SAS score groups. No differences were found and effect sizes were low (see Table 2).

Table 2

Trail Making and SAS High and Low

		High SAS M	Low SAS M
Trails Condition 1	$F(1,9) = 1.199$ $p = .302$, $\eta^2 = .118$	10.8	12.33
Trails Condition 2	$F(1,9) = 1.29$ $P = .285$, $\eta^2 = .125$	11.4	12.67
Trails Condition 3	$F(1,9) = 2.392$ p=.156, $\eta^2 = .210$	11.4	13.17
Trails Condition 4	$F(1,9) = .157$ $p = .702$, $\eta^2 = .017$	10.8	10.33
Trails Condition 5	$F(1,9) = 1.29$ $p = .285$, $\eta^2 = .125$	12.25	12.83

The Tower Test is a hands-on task that involves visual skills. Using the SAS groups, the Tower Total Achievement ($F(1,9) = 2.243$, $p = .168$, $\eta^2 = .199$) and Mean of 1st Move ($F(1,9) = 1.446$, $p = .260$ $\eta^2 = .138$), were analyzed using a MANOVA. No significant differences occurred between the SAS groups (Total Achievement $M = 10.33$, 12.20 (Low, High); M 1st Move = 9.83, 11.80 (Low, High)).

The Color-Word test is also visual involving reading color words, naming colors, inhibiting, and switching. A MANOVA was conducted showing no significant differences between the SAS total score groups. The *M*s were very close for all conditions between the groups are all within the average range (See Table 3).

Table 3

Statistical Sentences and Means for Color-Word Scores Between SAS TS Groups

		Low Ms	High Ms
Naming	$F(1,9) = .000$, $p = .984$, $\eta^2 = .000$	9.83	9.8
Reading	$F(1,9) = .195$, $p = .669$, $\eta^2 = .021$	10.5	10.0
Inhibition	$F(1,9) = 1.689$, $p = .226$, $\eta^2 = .158$	12.0	10.4
Switching	$F(1,9) = .022$, $p = .885$, $\eta^2 = .002$	9.83	10.0

EF Hypotheses

I hypothesized that differences would occur between golfers and non-golfers for their visuospatial planning, rule learning, and inhibition on the Tower Test and inhibition and cognitive flexibility during the Color-word Interference task. Using a MANOVA, a main effect was found for group on the Word Reading condition of the Color-Word test, $F(1,9) = 5.442$, $p = .045$), $\eta^2 = .377$, with a moderate effect size. The golfers had a higher standard score ($M = 12.5$) than the non-golfers ($M = 9.78$). The other conditions were not significantly different and effect sizes were minimal (Color Naming $F(1,9) = .011$, $p = .918$; Inhibition $F(1,9) = .818$, $p = .389$; Switching $F(1,9) = .359$, $p = .094$). These results do not support the hypothesis that inhibition and cognitive flexibility would be higher in skilled golfers.

I hypothesized there would be mean differences within the DKEFS-Tower Test between golfers and non-golfers as a reflection of visuospatial processing ability during a timed task with golfers taking more time to complete the task accurately, and have a higher mean time on the Tower Test. This was not supported by the data. There was no significant difference between the groups on the Mean 1st Move score ($F(1,9) = .176$, $p = .685$)

Heart rate variability as measured by RMSSD (Root Mean Square of the Successive Differences), the more reliable measure, was used to evaluate differences between the skilled golfers and the non-golfers for the executive functioning tests. A main effect for Color-Word was found (F91,9) = 12.389, $p = .007$, $\eta^2 = .579$) where golfers had a higher RMSSD value (M = 326.07) than non-golfers (M = 109.55) indicating their parasympathetic nervous system was activated (vagal tone). A main effect was found for RMSSD across the Trail Making conditions ($F(1,9) = 8.457$, $p = .017$, $\eta^2 = .484$) with golfers having an RMSSD M of 448.43 and non-golfers M = 179.54, again indicating that golfers were more in vagal tone than non-golfers during this task.

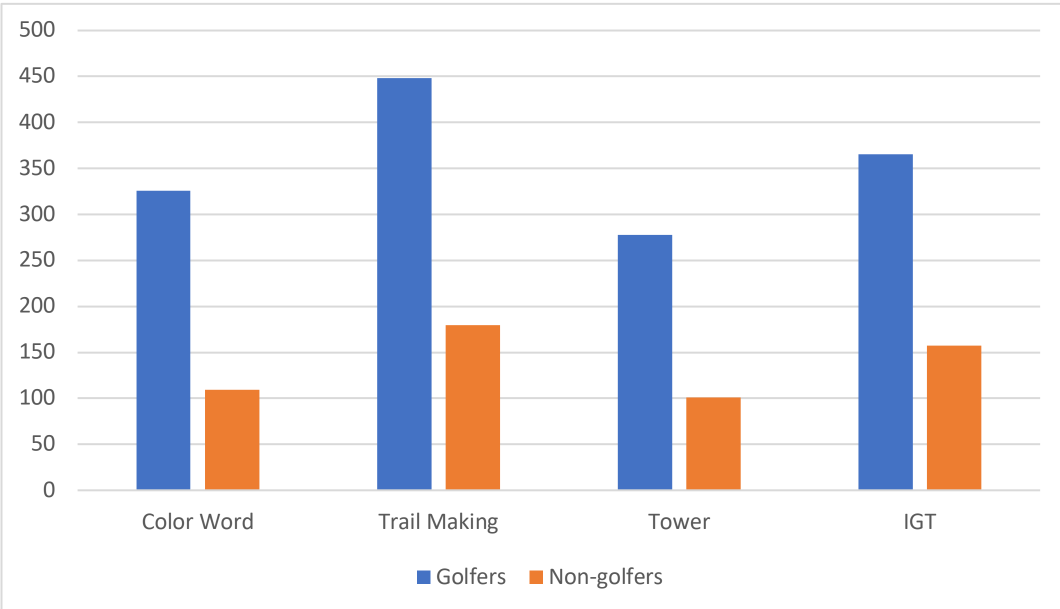
PPG was measured across the full Tower Test and the Iowa Gambling Test. For both of these tests a main effect was found using RMSSD for Tower ($F(1,9) = 13.69$, $p = .005$, η^2 = ,603) and IGT-2 ($F(1,9) = 30.288$, $p = .0001$, $\eta^2 = .771$). These results support my hypothesis (See Figure 2)

HRV Hypotheses

My hypothesis that golfers would outperform non-golfers was not supported because even with main effects, the golfers did poorer on the task. A MANOVA was conducted showing a trend (with a moderate effect size) for the net total score and a main effect the third set (out of 5 total sets). There was no difference in total money or in sets 1, 2, 4, and 5 (See Table 4, See Figure 3).

Figure 2

RMSSD Between Skilled Golfers and Non-Golfers During Executive Functioning Tasks



Note. Golfers had significantly higher RMSSD than non-golfers indicating the golfers were in vagal tone and their parasympathetic system was activated.

Table 4

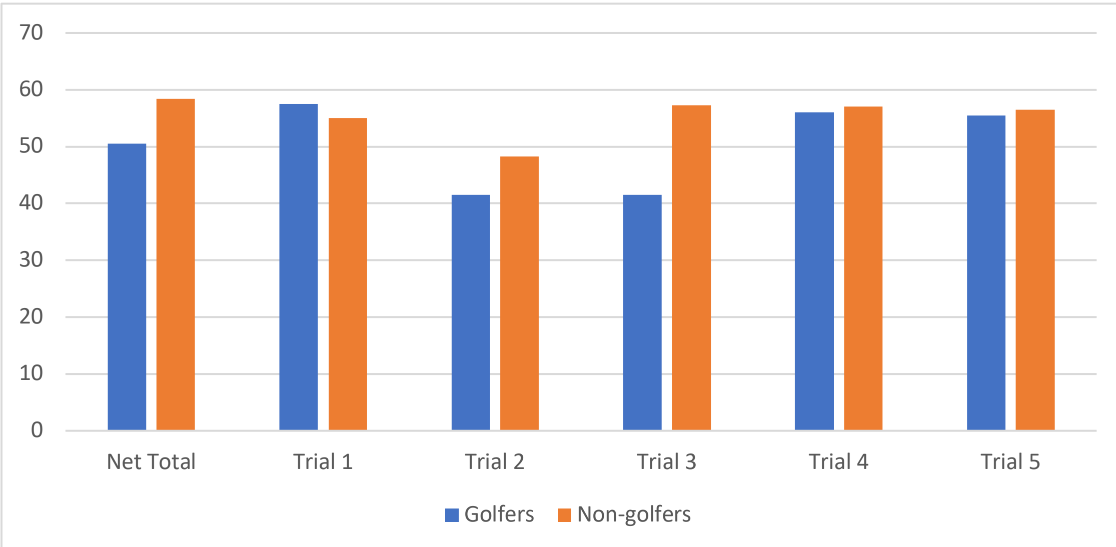
IGT Statistical Sentences

Net Total	$F(1,9) = 4.69$	$p = .059$, $\eta^2 = .342$
Trial 1	$F(1,9) = .037$	$P = .852$, $\eta^2 = .004$
Trial 2	$F(1,9) = 1.428$	$p = .263$, $\eta^2 = .137$
Trial 3	$F(1,9) = 10.019$	$p = .011$, $\eta^2 = .527$
Trial 4	$F(1,9) = 025$	$p = .878$, $\eta^2 = .003$
Trial 5	$F(1,9) = .014$	$p = .908$, $\eta^2 = .002$
Total Money	$F(1,9) = 441$	$p = .523$, $\eta^2 = .047$

Note. *Golfers lost $327.5, non-golfers gained $86.67.

Figure 3

IGT Means Between Golfers and Non-Golfers



Note. This figure shows the IGT-2 mean differences between golfers and non-golfers. Variability can be seen across trials with non-golfers outperforming golfers on the total scores.

PPG was combined across the full session. A significant difference was found between the golfers and non-golfer groups for RMSSD, $t(9) = 3.52$, $p = .007$, Cohen's $d = 2.752$, with a moderate effect size. The golfers had a significantly higher RMSSD ($M = 326.07$) than the non-golfers ($M = 109.55$) indicating the golfers were more in vagal tone across the experiment with its various tasks than the non-golfers.

I expected the sample to show higher EDA scores on the IGT-2 compared to the DKEFS-Tower test, Color-Word Interference test, and Trail Making Task Part B (Spreen, 2006). Repeated measures *t*-tests were done looking at EDA measures for the noted tasks. No significant difference was found for EDA on the IGT-2 or the DKEFS tests (see Table 5). The effect sizes are moderate to large and the means are in the hypothesized direction (see Figure 4).

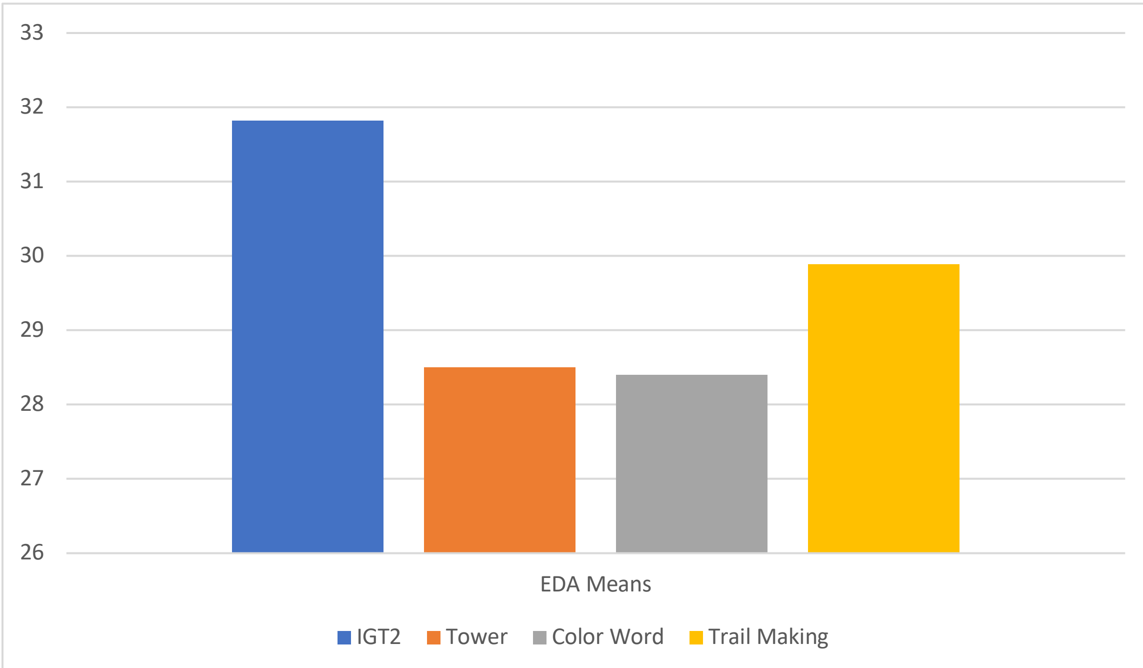
Table 5
Paired Samples Test

	t	*df*	Sig (2-tailed)	Cohen's *d*
Pair 1 EDA IGT Mean-EDA Tower Mean	.996	9	.346	.315
Pair 2 EDA IGT Mean Across Color-Word Conditions	.760	9	.462	.243
Pair 3 EDA Means Across DKEFS Trail Making Test - EDA IGT Mean	-.567	9	.584	-.179

Repeated measures *t*-tests were completed comparing RMSSD for the IGT-2 to each of the other tests. RMSSD was significantly different between the IGT-2 and Trails only, $t(10) = 3.006$, $p = .013$, Cohen's $d = .222$. The RMSSD was higher while doing Trail Making ($M = 228.423$) than while doing the IGT2 task ($M = 133.156$) indicating greater vagal tone during Trail Making.

Figure 4

EDA Means Across Executive Functioning Tasks



Note. This figure demonstrates the mean differences in EDA as participants moved across the tasks for measuring executive functioning.

Chapter 4

Discussion

With almost every important task, whether it is starting a paper, entering into an interview, or standing at the first tee at a golf tournament, a person can experience increased arousal that can enhance or interfere with performance. My interest is in why skilled golfers can be overcome with the experience of “first tee jitters” even after appropriate practice and confidence. I started data collection and COVID-19 changed the world. Because of the need to be in close proximity during data gathering and the closing of most activities during the time I was to gather data, the opportunity to include enough of the highly skilled golfers was interrupted. I was able to glean some results that I believe are interesting and give us a glimpse into possibilities but further research is needed to determine if these results have any merit.

Highly skilled golfers do manage their decision-making and anxious arousal in ways that are sometimes different than non-golfers, and sometimes surprising. Because of the low number of skilled golfers in this study, I needed to use caution in my interpretation of the data. I began by looking at whether anxiety levels were different between golfers and non-golfers. Relationships between state anxiety and cognitive performances are complex due to the influence of many factors (Potvin et al., 2012). High anxious arousal does not necessarily mean poor performance.

Physiological arousal data is gaining popularity with professional golfers (Labs, 2020). With the use of heart rate variability measured in new wrist technology company “Whoop,” athletes are beginning to use the physiological data in their performance regimes (Labs, 2020). While many athletes use this as a way to measure their body's need for recovery after sleep and workouts, the relationship appears more nuanced between physiological arousal, self-reported performance anxiety, and performance on EF abilities as was observed in this study.

Sample

All participants were educated with at least some college. Therefore, having a high achieving sample may have flattened EF performance that explained the lack of differences across participants. Many of the participants had greater access to information on healthy coping during competition. Ideally the study would have included golfers at various levels of excellence and performance such as professionals, semi-professionals, and competitive amateurs.

Anxiety and Performance

If a person rates themselves higher in anxiety, it is logical that their physiological response (EDA) would be higher. This was not supported, which calls into question whether participants accurately demonstrated self-awareness of anxiety during performance tasks. Additionally, it may be true that EDA is less sensitive to performance anxiety arousal than RMSSD.

Differences were not found between participants who rated high and those rating low anxiety in their performance on the EF measures. Grossbard et al., (2009) suggested the SAS Concentration Disruption subscale was not entirely clear and an area for recommended future study. It appears that my study furthers the confusing relationship between self-reported performance anxiety and physiological responses during competition.

In order to be a winning golfer, there are many skills needed at the time of the "performance" including visuospatial planning, rule learning, inhibition, and rapid decision-making. All of these skills can be interrupted by arousal levels. I expected skilled golfers would show strength in their inhibition and cognitive flexibility. While golfers did not score significantly better than non-golfers in these domains, their RMSSD was lower indicating greater parasympathetic arousal on these tasks. Golfers complete EF tasks with less anxious arousal than non-golfers.

Performance on a person-to-person test provides one type of information about ability. Physiological information provides an objective measure of arousal during tasks and performance. Using the RMSSD measure recorded during EF tasks, golfers were in vagal tone (parasympathetic arousal) compared to non-golfers. This suggests that even during challenging tasks, the golfers were able to manage their nervous system arousal more effectively than non-golfers.

Two tasks that required more active and quick decision-making were the Tower Test and the IGT-2. My hypothesis was supported with golfers experiencing less sympathetic arousal and less cardiac arousal during EF tasks compared to non-golfers. The similar data on the IGT-2 task indicates golfers experience less sympathetic arousal in the presence of risk reward situations during decision making indicating relative comfort with high pressure situations. This is likely due to repeated conditioning and subsequent comfort of skilled golfers in tournament conditions to perform under pressure. It may be true that competitive golfers are exposed to sports psychology methods of self-management during competitive tasks and practiced coping strategies during the task more than non-golfers.

I was specifically interested in the results of the IGT-2 because of its distractors during the tasks. As seen above the skilled golfers were able to remain physiologically “calm” during the tasks. Their scores on the tasks told a different story. In the presence of risk- reward, the skilled golfers performed poorer on the IGT-2 task. It is likely the golfers took greater risks spending their “money” during the task. It is possible that the lower sympathetic arousal within the golfers decreased their apprehension with risk-taking behavior. Golfers are accustomed to risk-taking based on the nature of golf as a sport. Thus, they need to be comfortable with risk-taking to be successful in their sport. Golfers also benefit from the ability to regulate their anxious arousal in the presence of risk situations which may also explain the poor performance and less arousal on these tasks.

EDA scores showed no differences between the IGT-2 and DKEFS tests. Again, EDA evidenced no significant differences in participants on performance tasks while RMSSD did. This furthers the notion that RMSSD is a more sensitive measure to the experience of physiological arousal in competition.

We found RMSSD was significantly lower during the IGT-2 EF task compared to the Trail Making task. This indicated that the Trail making task resulted in significantly less stress than the IGT-2 task. However, IGT-2 and Color-word Interference and Tower Test were not significantly different than the IGT-2 task. Interestingly, the IGT-2 is designed to focus on risk-reward stress situations alongside decision making and problem solving. Therefore, it appears that Color-word Interference and Tower Test not only measure their designed EF tasks, but that they measure these tasks in the context of significant physiological arousal. One would think this would show differences between high and low anxiety groups on self-report measures but there were no significant performance differences. Self-reported anxiety and decreased performance on EF tasks is not supported within these data. The self-report measures are not clinical tools but performance anxiety-based measures. It is possible that these tasks and may be susceptible to decreased performance from individuals with panic disorder or generalized anxiety above the clinical thresholds only. For these patients, the Trail Making task may be more reflective of their EF abilities without the presence of anxious arousal.

Limitations

COVID-19

Conducting physiological research in 2020 was a challenge. While this afforded the research a fresh and flexible approach to analyzing the data already collected, several of the original hypotheses were unable to be analyzed with such a low sample size. Research similar to this design requires physical contact with the examinees and does not abide by social distancing requirements.

Recruitment of highly skilled golfers within western Oregon was a challenge. These individuals are typically from affluent backgrounds and/or work full-time jobs. Therefore, both time and limited funding incentives contributed to the low turnout from this group. Collegiate golfers and collegiate athletes in general are difficult to recruit due to substantial time commitments to both athletic and academic responsibilities. Future research may benefit from multiple years of recruitment and relationship building with collegiate coaches in order to ensure participation of collegiate and highly skilled golfers.

Implications

Highly skilled golfers appear to display less sympathetic and more parasympathetic arousal in the presence of risk-reward competitive situations. Additionally, highly skilled golfers appear to be more comfortable with taking greater risks than non-golfers even if it leads to performing worse on decision making tasks with risk-reward. This is a fascinating development due to the inherent need of golfers to practice restraint and balance risk and reward during competition. If golfers were to feel less stressed and engage in riskier decisions, they may require stricter adherence to proactive game planning in order to mitigate their natural desire to take unthoughtful and unhelpful risks. This also highlights the importance of the well-researched "pre-performance routine" (Lei, Tenenbaum, & Land, 2016). One implication of this study would be for coaches to encourage "accountability" with fellow college players or caddies in weighing the risk and reward options during competition to serve as a check and balance system where a player would filter their desire to take risky decisions and remind them of the benefits a non-risky decision could have on their overall score. Additionally, self-reported anxiety did not appear to match RMSSD. Therefore, golfers may not be accurate historians of their experience of physiological arousal during competition. Golf coaches may wish to look for behavioral signals indicating high physiological arousal during competition such as increased breathing rate, faster walking between shots, flushed face, etc.

Future Directions

It appears that for the participants, self-reported anxiety had little effect on performance on EF tasks. Future research may benefit from exploring the role of physiological arousal as participants complete cognitive measures. Specifically, it is prudent to look at the differences in self-report anxiety and physiological data during performance and EF tasks for individuals who meet diagnostic criteria for DSM-5 anxiety disorders. This will contribute to the research literature regarding executive functioning as new insights regarding the role of anxiety within this complex cognitive domain.

The original study design intended on comparing the physiological arousal, self-reported anxiety, EF, and performance on a golf putting task between highly-skilled golfers who perform well under anxious arousal conditions and those who do not. Central to this study was the hypothesis that participants anxious arousal on the putting task and the IGT-2 EF task would be similar and therefore an adequate measurement of EF under physiological arousal within a putting competition. Our sample's physiological arousal on the IGT-2 task and the Tornado task was not significantly different. Therefore, future research on differences in EF on athlete performance under pressure should use the IGT-2 as the main EF measurement.

Conclusions

This study showed the importance of our physiological arousal has on our decision making. It also showed how much golfers differ from non-golfers on their comfort with risk and their ability to manage arousal during stress inducing situations as they are making decisions. We conclude that coaches who work with highly skilled golfers should take an active and directive role in teaching game planning strategy in addition to relaxation and focus techniques. This study brought questions regarding how helpful parasympathetic arousal is to decision making in risk reward situations for golfers. It may be true that greater anxious (sympathetic) arousal acts as a buffer to keep golfers from making risky and unhelpful decisions.

This study also showed that EDA may not accurately tell the story of the overall experience of anxious arousal in performance. However, the heart tells the story consistently. RMSSD consistently displayed differences between golfers and non-golfers where EDA did not and reflected the self-report measures with greater consistency. This study showed that the IGT-2 test and DKEFS Color word and Tower elicited similar levels of anxious arousal across participants. Trail making task however was less stressful than all other EF measures. Neuropsychologists administering these measures to participants can view the Trail Making task as an indication of EF in a parasympathetic response and the other tasks as an indication of EF performance in sympathetic arousal.

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Appendix A

Demographics

Please read the following items and answer as completely as possible.

Participant ID # ____________________

What is your gender? Male Female Transgender Other Decline to Answer (circle one)

What is your age: ___________________

Ethnicity origin (or Race): Please specify your ethnicity.

- White
- Hispanic or Latino
- Black or African American
- Native American or American Indian
- Asian / Pacific Islander
- Other

4. What is your marital status? (Circle One)
   - Single (never married)
   - Married
   - Separated
   - Widowed
   - Divorced
5. Handedness: Left-handed Right-handed Ambidextrous (Circle One)
6. Are you a native English speaker? (Circle One)
   - Yes
   - No
7. In terms of education and income, would you say your parents are (Circle One):
   - Upper class
   - Upper-middle class
   - Middle class
   - Lower-middle class

- Working class
- Decline to answer

8. What is your highest level of education (Circle One)?
   - Some High School
   - GED
   - Some College
   - Bachelor’s Degree
   - Some Graduate School
   - Master’s Degree
   - Doctoral degree

9. Do you practice meditation (i.e., mindfulness, religious based meditation)? (Circle One)
   - Yes
   - No

If yes, please specify how many days a week ___ and for how many minutes each day ____.

10. Have you experienced a concussion, TBI, or brain related injury/event? (Circle One)
    - Yes
    - No

If yes, please describe:

11. Have you been diagnosed with a mental disorder characterized by executive functioning deficits such as ADHD? (Circle One)
    - Yes
    - No
    - Decline to Answer

Appendix B

Golf Self-Efficacy Scale by Dr. Bert Hayslip, Jr.

Please circle your confidence level for each skill

0	10	20	30	40	50	60	70	80	90	100

Not at all Confident Moderately Confident Completely Confident

1. Be consistent driving from the tee	0	10	20	30	40	50	60	70	80	90	100
2. Having good alignment or posture	0	10	20	30	40	50	60	70	80	90	100
3. Select the correct club for a shot	0	10	20	30	40	50	60	70	80	90	100
4. Be consistent with short irons	0	10	20	30	40	50	60	70	80	90	100
5. Be consistent with long irons/hybrids	0	10	20	30	40	50	60	70	80	90	100
6. Be consistent in putting	0	10	20	30	40	50	60	70	80	90	100
7. Make adjustments to my grip of swing	0	10	20	30	40	50	60	70	80	90	100
8. Be consistent with my fairway woods	0	10	20	30	40	50	60	70	80	90	100

9. Having good course management skills	0	10	20	30	40	50	60	70	80	90	100
10. Hit trouble shots on the course	0	10	20	30	40	50	60	70	80	90	100
11. Sand play	0	10	20	30	40	50	60	70	80	90	100
12. Staying relaxed and focused while I play	0	10	20	30	40	50	60	70	80	90	100

Appendix C

Sport Anxiety Scale-2

REACTIONS TO PLAYING SPORTS

Many athletes get tense or nervous before or during games, meets or matches. This happens even to pro athletes. Please read each question. Then, circle the number that says how you USUALLY feel before or while you compete in sports. There are no right or wrong answers. Please be as truthful as you can.

	Before or while I compete in sports:	Not At All	A Little Bit	Pretty Much	Very Much
1.	It is hard to concentrate on the game.	1	2	3	4
2.	My body feels tense.	1	2	3	4
3.	I worry that I will not 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 others down.	1	2	3	4
	Before or while I compete in sports:	Not At All	A Little Bit	Pretty Much	Very Much
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
	Before or while I compete in sports:	Not At All	A Little Bit	Pretty Much	Very Much
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 tells me to do.	1	2	3	4

Scoring Key. Somatic: Items 2, 6, 10, 12, 14; Worry: Items 3, 5, 8, 9, 11; Concentration Disruption: Items 1, 4, 7, 13, 15.

Appendix D

Trail Making B

Appendix E

Curriculum Vitae

TAYLOR S. BROUGHTON

Curriculum Vitae

EDUCATION

DOCTOR OF PSYCHOLOGY, CLINICAL PSYCHOLOGY **AUGUST 2016- PRESENT**
(*Graduation expected April 2021)*
Graduate School of Clinical Psychology (APA-Accredited)
George Fox University
Newberg, Oregon

MASTER OF ARTS, CLINICAL PSYCHOLOGY **AUGUST 2016-MAY 2018**
Graduate School of Clinical Psychology (APA Accredited)
George Fox University
Newberg, Oregon

BACHELOR OF ARTS, PSYCHOLOGY **AUGUST 2008-MAY 2012**
Azusa Pacific University
Azusa, California

SUPERVISED CLINICAL TRAINING EXPERIENCE

INTERNSHIP (APA ACCREDIATED) **SEPTEMBER 2020-PRESENT**
Clinical Psychology Intern
Loma Linda School of Medicine-Department of Psychiatry
Redlands, California
Setting: Primary Care Psychology, Partial Hospitalization Program, Bariatric Surgery Evaluations, Inpatient Psychiatric Hospital
Supervision: Carlos Fayard, Ph. D, William Britt, Ph. D, Antonia Ciovica Ph. D, Jennifer Weniger, Ph. D

Currently serves as clinical psychology intern within a multi-rotational internship experience within the Loma Linda School of Medicine-Department of Psychiatry. Provides client-care and consultation services across academic medical center settings. Supervises several practicum student weekly assessment and therapy caseloads within inpatient and partial hospitalization programs for psychiatric hospital. Conducts Dialectical Behavioral Therapy (DBT) skills groups within partial hospitalization setting. Provide primary care behavioral health support across maternal family medicine, internal medicine, and smoking cessation clinics including evaluation, therapy, and assessment of suicide and homicide risk. Conduct psychological evaluations to determine patient readiness for bariatric weight-loss surgery. Personality assessments within partial hospitalization and inpatient hospitalization programs. Provide neuropsychological evaluations with medical students to diagnose problems with learning and attention and recommend appropriate learning accommodations.

PRE-INTERNSHIP **MAY 2019-MAY 2020**

Behavioral Health Consultant-Primary Care Neuropsychology Focus
Oregon Health Sciences University Department of Family Medicine, Portland Oregon
Setting: Academic Medical Center- Primary Care-Family Medicine
Supervision: Joan Fleishman, PsyD, Glena Andrews, Ph. D, ABPP, MSCP

Provided neuropsychological consultation within interdisciplinary teams of physicians, nurses, social workers, and medical assistants, providing both brief and comprehensive neuropsychological evaluations answering physician referral questions pertaining to attention deficits, academic difficulties, memory decline, post-stroke evaluation, and traumatic brain injury. Provision of feedback to patients and physicians regarding evaluation results and provide recommendations for treatment.

PRACTICUM 2 **JULY 2018-MAY 2019**

Behavioral Health Consultant
Oregon Health Sciences University Department of Family Medicine, Portland Oregon
Setting: Academic Medical Center-Primary Care-Family Medicine Clinic
Supervision: Joan Fleishman, PsyD

Worked within interdisciplinary teams of physicians, nurses, social workers, and medical assistants to provide behavioral health counseling aligned with patient health goals, completing both brief and comprehensive neuropsychological evaluations to answer physician referral questions pertaining to attention deficits, academic difficulties, memory decline, post-stroke evaluation, and traumatic brain injury, providing suicide, homicide, and psychosis risk evaluations as a part of interdisciplinary medical team.

PRACTICUM 1 **SEPTEMBER 2017-JULY 2018**

Student Therapist/Clinic Administrative Manager
George Fox Behavioral Health Clinic, Newberg, Oregon
Setting: Outpatient Community Mental Health

Supervision: Joel Gregor, PsyD

Served as a student therapist providing community mental health outpatient therapeutic services for children and adults from low-middle socioeconomic status backgrounds. Managed caseload of 8-10 clients weekly providing both brief and long-term psychotherapy services utilizing techniques and supervision from multiple theoretical orientations including ACT, CBT, Interpersonal, Solution-Focused, and Psychodynamic therapy. Risk assessment and treatment planning with clients endorsing suicidal, homicidal ideation and self-harming behavior. Completion of assessment for personality, learning disorders, and ADHD. Created and facilitated high school depression and anxiety groups in Cognitive Behavioral Therapy (CBT) and Acceptance and Commitment Therapy (ACT).

PRE-PRACTICUM **JANUARY 2017-MAY 2017**
George Fox University, Newberg, Oregon
Setting: College Counseling
Supervisor: Glena Andrews, Ph.D, ABPP
Population: Two adult university students.

Provided Person-Centered psychotherapy from initial assessment to termination. Sessions were videotaped, reviewed, and discussed in individual and group supervision settings.

BEHAVIORAL HEALTH CRISIS CONSULTATION TEAM **MAY 2018-MAY 2020**
Providence Newberg and Willamette Valley Medical Center Emergency Departments
Setting: Emergency Department- Risk Assessment
Supervision: Luann Foster, PsyD, Mary Peterson, Ph. D, ABPP, William Buhrow, PsyD, Joel Gregor, PsyD

Consulted within interdisciplinary teams of physicians, nurses, social workers, and medical assistants in emergency departments to provide brief mental health crisis evaluations. Assessment of patient risk of harm to self, others, psychosis, or competency to maintain health safety behaviors, development of care plans based on patient symptom presentations including inpatient psychiatric hospitalization, respite care, connection to community resources and safety planning, consultation with supervisors, physicians, family, and community resources to execute plan of care and prepare for discharge of patient to the appropriate level of care.

CLERGY ASSESSMENT SPECIALIST **FEBRUARY 2017-OCTOBER 2018**
-ASSISTANT
Private practice of Nancy Thurston, PsyD, ABPP

Proctored, scored, and provided interpretive feedback on fitness for duty assessments (MMPI-2, 16-PF, Incomplete Sentences, WMS-IV, Clinical Interview) with clergy and ministerial candidates across multiple denominations alongside licensed clinical psychologist Nancy Thurston, PsyD, ABPP.

OTHER CLINICAL EXPERIENCE

CHILD & FAMILY SPECIALIST- WRAPAROUND SERVICES **JANUARY 2014-MAY 2016**
Casa Pacifica Center for Children and Families
Community Based Mental Health Services
Camarillo, Ca

Provided mental health services to at-risk youth (5-19 years old) transitioning between home placements. Collaborated with multi-disciplinary team to improve coordination of care. Advocated for youth in school, foster care, group home, county behavioral health, probation, and human service agency settings. Served as crisis support. Received ongoing training in: The Person-Brain Model, a Neuro-Relational care approach- Dr. Paul Baker & Dr. Meredith White-McMahon, Multi-Sensory De-Escalation, and Didi Hirsch: Clinical Suicide Prevention.

EASTER SEALS OF SOUTHERN CALIFORNIA **JUNE 2012-JULY 2013**
Lead Behavior Interventionist- Autism Behavior Services
Ventura, CA

Provided in-home Applied Behavior Analysis (ABA) services to child and adolescent clients with Autism Spectrum Disorder. Collaborated with multi-disciplinary team to promote comprehensive early intervention therapy services. Conducted parent-training sessions, targeting parenting skills and educational goals. Mentored new staff members in evidence-based therapeutic methods, client etiquette and company policy. Served as a point of contact in staff development, reporting to supervisors on staff progress. Created educational program materials for clinical use. Collaborated with clinical team to develop and manage multiple treatment plans.

TEACHING/SUPERVISION OF STUDENTS

INTERN PEER SUPERVISION **SEPTEMBER 2020-PRESENT**
Peer group supervisor of doctoral practicum students working within inpatient and partial hospitalization programs. Provides didactic training on neuropsychological, cognitive, achievement, and personality measures to students. Provides report editing support and mentorship.

CLINICAL PEER SUPERVISION **SEPTEMBER 2019-MAY 2020**

Peer supervision of a Practicum 1 student's development and competency as a therapist. Video review of Practicum 1 student's therapy session and provide feedback under the oversight of licensed psychologist.

COGNITIVE ASSESSMENT- TRAINING CONSULTANT AUGUST 2019
Collaborated with previous teaching assistants to create training manual for incoming teaching assistants for cognitive assessment class. Provided in person training to incoming teaching assistants regarding class expectations and managing challenging student behaviors.

COGNITIVE ASSESSMENT-TEACHING ASSISTANT AUGUST 2018-DECEMBER 2018
Supervised group of six doctoral students of clinical psychology in the administration of Weschler cognitive, achievement, and memory assessment batteries. Evaluated standardization of administration via video recorded sessions. Evaluated accuracy of scoring test protocols and administration of cognitive testing batteries.

PEER WRITING MENTOR AUGUST 2018-DECEMBER 2018
Provided editing services and writing feedback to first year doctoral students in clinical psychology including but not limited to; professional writing style, APA manual expectations, time management, and program assignment expectations.

CONSULTATION EXPERIENCE

ORGANIZATIONAL CONSULTANT -NON-PROFIT SECTOR JANUARY 2019
Collaborated with multi-faceted non-profit organization managing and annual budget of $3.5 million to assess employee needs, satisfaction, and efficiency to help program executives identify areas of focus in the organization's 5-year vision plan. Provided feedback regarding organization strengths and growth areas to executive leadership with directions for future consultation and coaching. Employed a mixed method approach to researching organization needs including focus groups, open-ended questions, and utilizing peer reviewed corporate culture questionnaires.

RESEARCH EXPERIENCE

DISSERTATION- GOLF BRAIN: A NEUROPSYCHOLOGICAL STUDY OF SUCCESS IN COMPETITION MARCH 2019-February 2021 (Anticipated)

Approved for Data Collection: March 2019 Grants Awarded: Awarded $700 in Richter Grant Funding Dissertation Chair: Glena Andrews, Ph. D, APPP, MSCP.

TOWARDS HEALING: A STUDY OF PROFESSIONAL NEEDS AND EMPLOYEE BURNOUT IN NON-PROFIT ORGANIZATIONS **MAY 2019**
Where: Poster accepted to the Oregon Psychological Association Conference, Eugene Oregon.

HEART AND BRAIN RESPONSES TO AGGRESSION: STUDYING CONFORMING AND NON-CONFORMING MEN **FEBRUARY 2019**
Where: Poster presented at the International Neuropsychological Society New York.

RESEARCH VERTICAL TEAM GEORGE FOX UNIVERSITY
Dissertation Chair: Dr. Glena Andrews, Ph. D ABPP. Neuropsychology, Electroencephalography (EEG), and biofeedback training assisting dissertations related to neuropsychology.

PRESENTATIONS

SUCCESSFUL COLLABORATION WITHIN INTERDISCIPLINARY MEDICAL SYSTEMS **OCTOBER 2019**
George Fox Behavioral Health Crisis Consultation
Team Supervision Training

SIMPLE PLAY: THE BUILDING BLOCKS TO WORKING WITH CHILDREN AND ADOLESCENTS **OCTOBER 2018**
George Fox PsyD- Child and Adolescent Psychology
Student Interest Group Meeting

MOTIVATIONAL INTERVIEWING-AN OVERVIEW **SEPTEMBER 2017**
George Fox Behavioral Health Clinic
Newberg, Or

TEACHING MINDFULNESS SKILLS TO AT-RISK YOUTH USING GOLF **NOVEMBER 2015**
California Behavioral Services Conference
Los Angeles, Ca

PUBLICATIONS

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11 Strategies to Maximize Productivity While Working from Home

Time to Track Blog Published April 22, 2020
https://blog.time2track.com/author/tbroughton/

Navigating Negative Feedback: What I Learned as a Peer Supervisor
Time to Track Blog Published July 29, 2020
https://blog.time2track.com/author/tbroughton/

SELECTED PROFESSIONAL TRAINING EXPERIENCE

ACCEPTANCE AND COMMITMENT THERAPY (ACT) LEVEL 2 TRAINING **OCTOBER 2017**
Two-Days
Received hands on training in the Acceptance and Commitment Therapy (ACT) model from Steven Hayes, Ph. D focused on the Hexa-flex model of psychological flexibility.

ATTACHMENT FOCUSED PSYCHOTHERAPY- BROOKE KUHNHAUSEN, PH. D **DECEMBER 2017**
10 Sessions
Weekly process-based coursework in attachment theory and relational interventions. Specialized focus on using attachment focused interventions with traumatized populations. Self-reflective processing regarding personal attachment style and implications for the transference-countertransference dynamics in the therapeutic relationship.

PROVIDENCE HEALTH DEPRESSION AND ANXIETY RECOVERY PROGRAM **SEPTEMBER 2016**
Eight Sessions
Group Facilitator
Led small group process and discussion for 8-week psychoeducation course on cognitive behavioral approaches to managing depression and anxiety.

INTER-CULTURAL COMMUNICATION **OCTOBER 16, 2019**
1-Day Training
Cheryl Forrester, PsyD

PROMOTING FORGIVENESS **SEPTEMBER 25, 2019**
1-Day Training
Everett Worthington Jr., Ph. D

FOUNDATIONS OF RELATIONSHIP THERAPY- THE GOTTMAN MODEL **MARCH 20, 2019**
1 Day Training
Douglas Marlow, Ph. D

OPPORTUNITIES IN FORENSIC PSYCHOLOGY **FEBRUARY 13, 2019**
1 Day Training
Diomaris Safi, PsyD and Alex Millkey, PsyD

OLD PAIN IN NEW BRAINS **OCTOBER 10, 2018**
1 Day Training
Scott Pengelly, Ph. D

SPIRITUAL FORMATION AND THE LIFE OF A PSYCHOLOGIST: **SEPTEMBER 26, 2018**
LOOKING CLOSER AT SOUL-CARE
1 Day Training
Lisa Graham McMinn, Ph. D and Mark McMinn, Ph. D

INTEGRATION AND EKKLESIA **MARCH 14, 2018**
1 Day Training
Mike Vogel, PsyD

HISTORY AND APPLICATION OF INTERPERSONAL PSYCHOTHERAPY **FEBRUARY 14, 2018**
1 Day Training
Carlos Taloyo

TELEHEALTH **NOVEMBER 8, 2017**
Jeff Sordal, PsyD

USING COMMUNITY BASED PARTICIPATORY RESEARCH (CBPR) TO PROMOTE MENTAL HEALTH IN AMERICAN INDIAN/ALASKA NATIVE (AI/AN) CHILDREN, YOUTH AND FAMILIES **OCTOBER 11, 2017**
Eleanor Gil Kashiwabara, PsyD

DOMESTIC VIOLENCE: A COORDINATED COMMUNITY RESPONSE **MARCH 1, 2017**
Patricia Warford, PsyD and Sgt. Todd Baltzell

SELF-ACTUALIZATION: ITS ASSESSMENT AND APPLICATION IN NATIVE THERAPY **FEBRUARY 8, 2017**
Sydney Brown, PsyD

WHEN DIVORCE HITS THE FAMILY: HELPING PARENTS AND CHILDREN NAVIGATE **NOVEMBER 9, 2016**
Wendy Bourg, Ph. D

SACREDNESS, NAMING AND HEALING: LANTERNS ALONG THE WAY **OCTOBER 12, 2016**
Brooke Kuhnhausen, Ph. D

APPLIED COURSEWORK

DOCTORATE IN CLINICAL PSYCHOLOGY

Completed coursework in Ethics, Clinical Foundations I-II, Psychopathology, Lifespan Development, Theories of Personality, Personality Assessment, Learning Cognition and Emotions, Social Psychology, Spiritual Integration, Psychometrics, Family Therapy in a Diverse Culture, Bible Survey for Psychologists, Cognitive Behavioral Therapy, Cognitive Assessment, Spiritual Formation I-II, Multicultural Therapy, Psychodynamic Therapy, Spiritual Formation, History and Systems of Psychology, Research Design, Child Therapy, Spirituality and Religion in Psychology, Neuropsychology Assessment and Intervention, Biological Basis of Behavior, Consultation in Professional Psychology, Child and Adolescent Treatment, Supervision and Management, Professional Issues, Spiritual and Religious Issues.

REFERENCES

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