EVALUATIVE AUDIENCE EFFECTS ON PERCEPTION IN A SPORT TASK

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ABSTRACT

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The presence of an evaluative audience is known to influence task performance, but the mechanism by which it influences performance is unknown. In an attempt to identify this mechanism, this study investigated whether the presence of an evaluative audience would also impact perception of the task target’s spatial characteristics (i.e., distance to the hole and hole size). Experienced and novice golfers putted a golf ball from various distances and toward target golf holes of various sizes, with and without an evaluative audience present. Participants then made spatial judgments of the golf hole after putting the ball. The results showed that in the presence of an evaluative audience, novices perceived the hole as closer than did experienced golfers. However, novices putted with less accuracy than experienced golfers. These results suggest that social facilitation effects differentially impact spatial perception based on task experience.

Keywords: social facilitation, perception, evaluative audience
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CHAPTER I
INTRODUCTION

It is a common occurrence in sports that some people perform worse in front of an audience as opposed to no audience, whereas others perform better in front of an audience. Various social facilitation explanations may be able to account for these performance differences. Social facilitation refers to instances in which the presence of others improves the accuracy or performance of an individual. There are two mechanisms by which the presence or absence of an audience may impact sport performance: at the level of output, which involves physical movement, or at the level of input, which involves sensation and perception. This study tested the possibility that the presence of an evaluative audience impacts visual-spatial perception of the task target, which in turn impacts task performance.

**Level of Output: Social Facilitation Affects Performance**

Triplett (1898) introduced social facilitation research when he observed that when competing with others at a simple motor task, some people performed better than when alone, whereas the opposite was true for others. There are multiple theories that propose mechanisms by which social facilitation occurs, including a biopsychosocial model, in which performance in the presence of others is understood in terms of a challenge-threat
response (Blascovich, Mendes, Hunter, & Salomon, 1999). The current research proposal, however, will concentrate on two general mechanisms of social facilitation: self-focus/reinvestment and drive.

**Self-focus/reinvestment theories**

Self-focus theories of social facilitation suggest that the presence of others during task performance increases an individual’s self-focus (i.e., concentration on one’s own thoughts, behaviors, appearance, and decisions) and performance anxiety. This heightened anxiety and attention toward oneself leads to greater focus on the step-by-step execution of the skill, which is believed to impair well-learned, or proceduralized, skill performance. Some ways to manipulate self-focus include placing a mirror in front of a person performing a task or video recording a person’s task performance (Liao & Masters, 2002; Beilock & Carr, 2001). It appears that more stressful situations are related to greater self-focus. Liao and Masters (2002), for example, found that experienced hockey players’ self-focus levels were high before a stressful match but were much lower after the match. This indicates that the more anxiety one experiences, the more self-focused one becomes.

Additional research findings lend further support for self-focus theory. Liao and Masters (2002) found that novices who were more self-focused when they practiced basketball free throws reported more explicit knowledge of the task (i.e., more steps in the task process), and the more explicit knowledge they had of the task, the more likely their performance was to suffer under stress (to induce stress, participants were video recorded and evaluated by experts, and were given money for each shot made). Thus, it appears that stress is more detrimental to performance when the person has more explicit
knowledge of the task as a direct result of having more self-focus. Increased self-focus due to stress could create an over-awareness of the task process, resulting in poorer performance. This evidence, however, is in direct contrast to that of Beilock and Carr (2001), whose results implied that learning how to putt a golf ball under a condition of high self-focus provides a defense against performance failure under pressure. Novices who were self-focused when they learned the task performed better under pressure than those who were not self-focused when they learned the task. One major difference between these two studies that could explain the disparate findings is that in the former study, participants were specifically told to focus on the process of the task and were tested on their knowledge of the process. By contrast, in the latter study participants were simply video recorded and told the recording would be reviewed. Another potential explanation for these findings is that although both studies included novices, in the former study the novices presumably had minor experience with shooting a basketball, and in the latter study the novices presumably were learning how to putt the ball.

In line with self-focus research is the concept of reinvestment. Reinvestment is different from self-focused attention in that it is a personality variable that encompasses elements of rehearsal, private and public self-consciousness, and cognitive failures. Reinvestment involves the disruption of the automaticity of task performance. This disruption results from consciously applying specific knowledge components of the task while performing the task (Otten, 2009; Masters, Polman, & Hammond, 1993). High reinvestment appears to impair performance on more complex tasks, such as a golf-putting task, than on less complex tasks, such as a rod-tracing task (Masters, Polman, & Hammond, 1993). In a golf-putting task, high reinvesters, as assessed by their scores on
the Reinvestment Scale, were more likely to perform worse under pressure (pressure was induced with money) than low reinvesters. Additionally, high reinvesters from two university sport teams were reported by their teammates to choke more under pressure in game situations than low reinvesters. This suggests that performance pressure affects the extent to which one reinvests, and high reinvestment differentially affects performance based on task complexity. Otten (2009) also studied reinvestment and found that experienced basketball players who were videotaped shooting free throws performed better under pressure than when they were not under pressure. High reinvesters performed worse under pressure than low reinvesters. Although high reinvesters experienced greater cognitive and somatic anxiety and self-focus, only cognitive anxiety was related to performance under pressure. Those who experienced more cognitive anxiety performed worse under pressure. Otten (2009) suggested that perhaps an appraisal measure would better replace an anxiety measure, such that how a person interprets symptoms of anxiety might be more strongly indicative of performance. An appraisal measure of anxiety would fall in line with Blascovisch et al.’s (1999) biopsychosocial model of a challenge-threat response. Importantly self-focus, unlike in the former studies, did not impact performance. Participants who had greater perceived control (i.e., how in-control of the task they felt) performed better than those who had less perceived control. Although this study does support the relation between reinvestment and anxiety under pressure, perceived control rather than self-focus had the greatest impact on performance.

The way in which self-focus or reinvestment is said to hinder performance is by disrupting the automatic processing of the task at hand. This is especially relevant when
considering experienced performers, whose task execution is automatic. Therefore, it should follow that if reinvestment disrupts the automatic processing of a task, experienced performers rather than novice performers should be negatively affected. Indeed, a number of studies support this notion. Baumeister (1984) found that increased conscious attention to the task process led to declined performance. Various manipulations of pressure, including the presence of an audience, also resulted in declined performance, thus providing further support for audience effects on performance. Beilock, Carr, MacMahon, and Starkes (2002) provided evidence that further supports the relation between task monitoring and task performance. Experienced golfers putted under two conditions: a dual-task condition, which diverted attention from putting, and a skill-focused condition, which drew attention to step-by-step monitoring of putting. Golfers in the dual-task condition performed better than when in the skill-focused condition, which implies that thinking of the task process leads to poorer task performance. A second, similar study suggests that step-by-step monitoring hinders experienced performance but enhances novice performance. Experienced and novice soccer players performed a dribbling task under dual-task and skill-focused conditions. When using their dominant foot, experienced players performed better in the dual-task condition, but when using their non-dominant foot, they performed better in the skill-focused condition. Novices performed better in the skill-focused condition, regardless of which foot they used to dribble the ball. This study indicates that experienced players’ performance can be negatively affected by focusing on the process of skill execution when that skill comes “naturally”, or without conscious effort. Experienced players’ performance can be positively affected by monitoring skill execution, however. This can
occur when a task might require more effort or focus on performing the skill – in this case, dribbling with a non-dominant foot. Novice players required high amounts of effort and focus when dribbling, regardless of which foot they used to dribble the ball, which is why they always performed better in the skill-focused condition.

Overall, the social facilitation findings concerning self-focus/reinvestment suggest that performance pressure is easily manipulated by various factors: the presence of an audience, mirror, video camera, team rivalry, or incentives. When people are under pressure they become more conscious of the task procedure, and this consciousness can either enhance or impair performance based on task experience. People experienced at a task perform better when they are unaware of the step-by-step execution of the skill (i.e., when the performance is more automatic), whereas novices at a task perform better when their performance is not yet automatic and when they focus on this step-by-step execution.

**Drive theories**

Another explanation for social facilitation effects is differences in learned drive. The learned drive account of social facilitation states that people learn to experience more evaluative apprehension in the presence of evaluative experts than in the presence of a non-evaluative audience (Cottrell, Sekerak, Wack, & Rittle, 1968). Zajonc’s (1965) original drive theory of social facilitation states that the mere presence of others, regardless of whether they are spectators or co-actors on a task, increases one’s drive, or arousal, level, which then increases the occurrence of one’s habituated, or dominant, response. In other words, an individual’s tendency to perform well or poorly on a task is amplified by the mere presence of others. For complex or unlearned tasks, the dominant
response is to perform poorly, and for simple or well-learned tasks, the dominant response is to perform well (Strauss, 2002). Although drive theory accounts for performance differences due to the mere presence of others, learned drive theory provides that performances differences are found in the presence of an audience that has evaluative potential. Cottrell et al.’s (1968) research findings support this learned drive account. Participants performed a pseudorecognition task in one of three conditions: alone, in the presence of spectators, or in the presence of non-spectators. Participants’ dominant response was to recall fewer words in fewer-frequency training conditions and more words in greater-frequency training conditions. Participants experienced dominant responses more so in the presence of spectators than in the presence of non-spectators. This indicates that it is the evaluative potential of an audience that leads to increased drive.

Among those whose research provided support for Cottrell et al.’s (1968) approach, Henchy and Glass (1968) and Paulus and Murdoch (1971) found that anticipated evaluation by spectators is enough to induce one’s dominant responses on a task. In both studies, participants performed a pseudorecognition task. Participants experienced more dominant responses when they thought they were being evaluated. When they did not think they were being evaluated, they experienced the same amount of dominant responses. Participants who thought they were being evaluated, whether in the presence of experts or alone, experienced more dominant responses than those who performed alone or in front of non-evaluating students. These findings suggest that as long as one expects to be evaluated by an audience, regardless of whether this evaluation occurs, one will experience increased drive and social facilitation effects. Both of these
studies support the learned drive approach: it is the evaluative potential of an audience, whether present or not, rather than the mere presence of others, that impacts performance.

The previous two studies provide strong support for Cottrell et al.’s (1968) approach, but there are other studies that lend only partial support for the learned drive account. Bell and Lee (1989) found that skilled karate students were as accurate in their kicks and committed as many kick errors when karate experts were watching as when no audience was watching. Unskilled karate students were less accurate in their kicks when karate experts were watching, which lends partial support for the learned drive account.

In summary, there are multiple studies that support the learned drive approach to social facilitation. However, some studies lend either partial support or provide evidence to refute it. Bond and Titus (1983) summarized these findings in a meta-analysis of social facilitation studies, in which they concluded that task complexity is important when considering social facilitation findings. They found that the presence of non-evaluative others lessened drive during complex tasks but impaired quantitative and qualitative performance of complex tasks. Non-evaluative others enhanced quantitative performance of simple tasks but did not affect drive during simple tasks, however. The finding that a non-evaluative audience enhanced performance of simple tasks but impaired performance of complex tasks is in line with Zajonc’s (1965) position that the mere presence of an audience creates social facilitation effects. What is not in line with the mere presence effect is that drive was either unaffected or lessened in the presence of non-evaluative others. An evaluative audience, however, raised drive during complex tasks, lending only partial support for both theories, since according to these theories, an audience should increase drive regardless of task complexity. Concerning observer status, experts but not
peers enhanced qualitative performance (e.g., errors) of simple tasks and peers but not experts enhanced quantitative performance (e.g., response rate) of simple tasks. Again, these findings partially support both theories. Social facilitation research is overall divided in support of the mere presence and learned drive accounts. However, the evaluative component of the learned drive approach is a unique addition to the original drive theory of social facilitation, and it is this approach on which the following study was based.

Level of Input: Altered Perception Affects Performance

Besides changing the performer’s physical movement (level of output), there is a second mechanism by which social facilitation could influence performance: changing the way the performer perceives the visual-spatial components of the task (level of input). The notion that social facilitation can change the performer’s visual-spatial perception is reasonable given that research has demonstrated that both visual and non-visual factors can influence perception. In addition to visual components there are several non-visual components that influence spatial perception. These non-visual components include: effort, intent, physiological/behavioral potential, task performance, and anxiety. Following is a review of the research involving these factors and their impact on spatial perception.

Witt, Proffitt, and Epstein (2004) demonstrated the impact of effort on visual perception in their study in which perceived distance was influenced by perceived effort involved in traversing the distance. Participants walked on a treadmill while experiencing zero optic flow, a visual indicator of self-motion. Following this treadmill walking, participants overestimated the distance to targets on the ground. This suggests
that the lack of optic flow increased the amount of anticipated effort to produce optic 
flow needed to reach the target, which increased perceived distance to the target.

In a later study that involved reaching a target, Witt, Proffit, and Epstein (2005) 
found that perceived distance to a target within reach while holding a baton was closer 
compared to targets that were beyond reach without holding a baton. The perceiver’s 
intent also impacted distance perception. Whether a target was reachable only influenced 
perceived distance when the perceiver intended to reach to the target. Simply holding a 
baton but not reaching with it did not affect distance perception. These results suggest 
that both intent and ability play a role in target perception.

Physiological and behavioral potential also can impact spatial perception. For 
example, hills appear steeper to people who are wearing a heavy backpack, fatigued, 
physically unfit, or elderly (Bhalla & Proffitt, 1999). Similar to the effects of anticipated 
effort described earlier, this can be explained in terms of metabolic costs associated with 
a task. When the metabolic costs of a task increase, perception can be altered. For 
extample, when the metabolic costs of walking increase, hills appear steeper and targets 
farther away (Proffitt, 2006). However, there is controversy concerning whether the 
influence of wearing a heavy backpack on depth perception is due to experimental 
demand (Durgin, Baird, Greenburg, Russell, Shaughnessy, & Waymouth, 2009; 
Hutchison & Loomis, 2006).

Another factor that influences perception of a task target is task performance. The 
way in which task performance might impact perception of a target is that when one 
performs well, the evaluation of that performance will be positive and should lead one to 
perceive the target in a way that can partially account for why he or she performed well.
For instance, hitting a home run in baseball might lead one to perceive the ball as bigger than if he or she strikes out at home plate. Wesp, Cichello, Gracia, and Davis (2004) provide some evidence for this effect. In their study, participants threw darts down at a circle and then gave size estimates of the target, with the target out of sight. Those who hit the target only after multiple attempts or who did not hit the target at all perceived the circle as smaller. By contrast, those who hit the target in fewer attempts perceived the circle as larger. In another part of this study, participants either estimated target size before throwing darts, or threw darts and then estimated target size. Participants gave their estimates while viewing the target. Those who threw darts and then gave size estimates perceived the target as smaller the more attempts it took to hit the target, whereas those who threw darts after giving size estimates did not perceive the target size differently, regardless of how many attempts it took to hit the target. These results suggest that task performance feedback can influence perception of the task target. In this case, those who experienced difficulty hitting the target perceived it as smaller than those who experienced no such difficulty.

Additional research supports this relation between performance feedback and target perception. Witt and Dorsch (2009) studied participants’ perception of a football field goal post before and after kicking a field goal and found that participants’ perceived height and width of the post was related to their kicking performance. Participants who made more field goals perceived the posts as farther apart and the crossbar as lower than those who made fewer field goals. However, these perceptual differences were related to performance only when participants gave perceptual estimates after they kicked the football. Participants who gave their estimates before kicking the football did not differ in
their perceptions of the post. This again suggests that performance feedback influences one’s perception of a task target. These performance-induced differences in perception have also been found in golf and softball. Participants who had lower scores after a round of golf perceived the golf hole as bigger than participants who had higher scores (Witt, Linkenauger, Bakdash, & Proffitt, 2008). Participants’ golf handicaps were not related to their size perceptions, meaning better golfers did not perceive the hole differently than golfers who were not as good. Thus, it appears that perceptual differences are dependent on performance at the time one perceives the target, not on one’s general task skill level. However, softball players with a higher batting average have been found to perceive the ball as bigger than those with a lower batting average, which suggests that when there is no real-time performance feedback, general skill level might have more of an impact on target perception (Witt & Proffitt, 2005). These studies all suggest that performance feedback on a task influences perception of the target in the task. Performance feedback in the form of audience evaluation as well as one’s own evaluation, then, should impact target perception.

Other research has shown that emotional arousal like fear can alter perception of spatial dimensions such as height (Stefanucci & Proffitt, 2009). Participants overestimated height more greatly when standing on a balcony and looking down than when standing on the ground and looking up at the balcony. Additionally, those with greater state and trait fear of heights tended to more greatly overestimate height. These results suggest that anxiety associated with fear of heights can influence height perception, particularly when a person is judging height while looking down. Although anxiety appears to affect visual-spatial perception, the extent to which one experiences
anxiety seems to play a role. For instance, one may experience altered perception in conditions of low but not high anxiety (Canal-Bruland, Pijpers, and Oudejans, 2010). Conditions of low anxiety had a marginal effect on size perceptions of a target in a dart-throwing task. Those who performed better (i.e., had smaller radial errors, measured from where the dart landed to the center of the target) in the low or no anxiety condition perceived the target as bigger than those who performed worse (i.e., had larger radial errors) in the low or no anxiety condition. By contrast, those in the high anxiety condition did not differ in their size perceptions of the target, regardless of their performance.

Since various social, embodied, and emotional factors have been shown to influence visual-spatial perception, it is reasonable to examine the impact of altered perception on task performance. This study evaluates the notion that social facilitation may impact perception, which in turn could influence task performance. Whereas self-focus/reinvestment and drive theories indicate the presence of others indirectly causes a change in output (i.e., task execution), an alternative mechanism for social facilitation effects is that there is also a change in input (i.e., how task-specific stimuli are perceived in the task environment). The way in which social facilitation might impact performance is through the presence or absence of anxiety, which can influence perception. The presence of an evaluative audience might induce anxiety, and when one experiences heightened cognitive or somatic anxiety, this increased anxiety can alter one’s perception of a task-relevant target. The absence of an evaluative audience should not affect anxiety, and when one does not experience heightened anxiety, his or her perception should be more accurate.
Purpose of this Study

With regards to perception, there is growing support for the theory that suggests spatial perception is influenced by multiple influences other than purely visual cues (e.g., effort, anxiety, etc.). There is also evidence that supports social facilitation effects, thereby indicating that the presence of an audience enhances some people’s performance but impairs others’ performance. In particular, the presence of an evaluative audience seems to improve skilled or easy performance and impair unskilled or difficult performance, in line with learned drive theory. Whereas research has addressed the malleability of perception in sport tasks and the influence of an audience on performance of sport tasks, there is no research that directly connects these two concepts. Thus, this study examines a proposed mechanism by which social facilitation occurs: performance evaluation causes a change in visual-spatial perception which impacts performance of a golf-putting task. One potential link between the presence of an evaluative audience and visual-spatial misperception is the performer’s anxiety. The presence of an evaluative audience might increase one’s level of anxiety, and this heightened anxiety might change one’s visual-spatial perceptions of the golf hole, depending on the performer’s skill level. It is expected that both experienced and novice golfers’ performance of the task and perception of the golf hole will vary as a function of the presence or absence of an evaluative audience. Most important is the predicted interaction between experience and the presence or absence of an evaluative audience on measures of spatial perception and task performance. Experienced golfers are expected to perceive the hole distance and size accurately or as closer and larger when in the presence of an evaluative audience than when in the absence of an evaluative audience. Additionally, they are expected to
perform as well or better in the presence of an evaluative audience than in the absence of an evaluative audience. In general, experienced golfers are expected to perform better and perceive the hole as closer and larger than novices, regardless of the presence or absence of an evaluative audience. Novice golfers are expected to perceive the hole as farther away and smaller when in the presence of an evaluative audience than when in the absence of an evaluative audience. Novice golfers’ altered perception of distance to and size of the golf hole might be a mediating mechanism between social facilitation and choking under pressure. Lastly, it is expected that novices will experience greater anxiety than experienced golfers in both conditions and also greater anxiety when in the presence of an evaluative audience than when in the absence of an evaluative audience. It is expected that experienced golfers will experience low anxiety both in the presence and absence of an evaluative audience.
CHAPTER II

METHOD

This study was designed to examine the effects that evaluation and task experience have on spatial perception and task performance. Novice and experienced golfers were randomly assigned to an evaluation condition or a no-evaluation condition. Participants in the evaluation condition were shown a video camera and an experimenter operating the camera, both in plain view of where the participant was to putt. Participants were told that the camera would record their performance and putting technique and that the experimenter operating the camera would take notes on their putting technique. They were also informed that both the recording and notes would later be viewed by a golf coach from the surrounding area as part of a research project on the utility of practice putting mats, putting technique, and experience. Both the camera and experimenter operating the camera were removed from sight and participants were told nothing about being evaluated in the no-evaluation condition. Participants putted from three distances and toward a hole of three diameters with no feedback as to putting accuracy. After each putting trial their size and distance estimates and putting accuracy were recorded as a measurement of the impact that evaluation can have on spatial perception and task performance.
Participants

Thirty-eight students (30 men and 8 women; data from one student was excluded due to equipment failure) at a Midwestern university participated in this study either for course credit or for entry into a lottery for the chance to win a $25 gift card to the university bookstore. One participant was not a student at the university. A power analysis conducted via G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) indicated a 95% chance of detecting an estimated .37 effect size for each of the 3 x 2 x 2 interactions. According to this, data from 20 participants was necessary to attain the desired power of .95. Twenty-one “experienced” golfers were recruited from the university’s varsity and club golf teams. They golfed between three and 200 times per year ($M = 80.90, SD = 55.30$) and their golf handicaps ranged from scratch (zero) to 20 ($M = 7.00, SD = 5.00$). Experienced golfers played in a school league or other competitive league either in the past or at the time of the study. Seventeen “novice” golfers were recruited from introductory psychology courses. Novice golfers overall had no competitive golf experience, had not golfed in a school or other competitive league either in the past or at the time of the study, and at the time of the study golfed non-competitively between zero and 25 times ($M = 6.70, SD = 7.30$) per year.

Materials

**Golf experience questionnaire.** Along with demographic questions, this measure included questions about participants’ past and current golf experience, how often they play per year, and how they rate their level of golf skill on a rating scale, from 1 (*unskilled*) to 5 (*skilled*).
As a manipulation of the presence or absence of an evaluative audience, an experimenter operated a Sony video recorder that was mounted on a tripod. Heart rate was recorded to assess anxiety as a function of this evaluation condition. Heart rate has been used as an indicator of performance and state anxiety in previous studies (Thurber, Bodenhamer-Davis, Johnson, Chesky, & Chandler, 2010; Hodges, 1968). Participants’ heart rates were recorded via a heart rate monitor strap that they wore around their chest. The strap sent heart rate information via Bluetooth to the experimenter’s phone using a Polar heart rate application. The phone was kept away from participants’ sight during the experiment, and participants’ heart rates were recorded before and after each putting trial.

Noise-cancelling headphones were used to block out any environmental noise so that participants would not be distracted while performing the task and so they would not receive performance feedback by hearing where the ball landed once they putted. The headphones were connected to an mp3 player that played a white noise recording. The volume was adjusted so that participants could not hear any outside noise but could comfortably listen to the white noise recording for the duration of the experiment. The experimenter spoke to participants via a microphone that was wirelessly connected to the headphones participants wore.

A green artificial turf putting mat (9.14 x .76 m) was used for the putting trials. The putter used was 89.00 cm. Putting distances during practice trials were 2.25, 3.75, or 5.25 m from the hole, and during experimental trials they were 3.00, 4.50, or 6.00 m from the hole. Two round inserts were fitted into the golf hole to adjust the hole diameter between putts. The hole diameter was 7.62, 12.70, or 17.78 cm during any given trial.
Though randomized, participants were guaranteed to putt from each of the three distances and toward each of the three hole sizes in the practice trials.

A Bosch laser tape measure was used to measure the distance between where the ball landed after being struck and the center of the hole (i.e., putting performance). A flashlight was used with the tape measure because the room was dark when these measurements were taken.

Whether participants gave the size or distance estimate first was determined randomly each trial. The size estimate involved verbally selecting the numbered circle that was the same size as the golf hole toward which they had just putted. Participants were presented with a poster board that displayed seven black circles of 5.08 to 20.32 cm diameters, representing potential sizes of the golf hole. The distance estimate involved verbally stating how far participants thought the hole was from where they had just putted the ball, in feet, meters, or yards. Though more variable than blind walking, verbal reports are also commonly used as an indication of perceived distance (Loomis & Philbeck, 2008). Participants were instructed to view the golf hole from where they had putted the ball for as long as they would like before giving their estimates, but that once they were ready to give their estimates, to turn and look away from the hole.

**Procedure**

The presence or absence of an evaluative audience was treated as a between-subject variable. Participants were run through the experiment individually over the course of an hour. Participants individually arrived at the lab, gave their informed consent, and were given an eye exam using the Snellen eye chart. Following the eye exam, participants completed the golf experience questionnaire. Participants then fitted a
heart rate monitor strap to their chest in a private room adjacent to the main lab room. Once the monitor was in place, participants put on noise-cancelling headphones before heading into the main lab room.

Participants then were told they would be taking three practice putts on the putting mat. They were informed that these were practice trials and they would not count for anything. They were then instructed on how to report their size and distance estimates and were shown a meter stick as a visual reference for the distance estimate before beginning the practice trials. Following the instructions, participants were given the putter to begin the trials. To prevent error feedback from influencing anxiety, putting performance or spatial judgments, the light was turned off and participants turned and faced away from the putting mat twice each trial: once while the putting distance and hole diameter were adjusted and again as soon as participants struck the ball. While the light was off and participants faced away, an experimenter measured the distance between where the golf ball landed after being struck and the center of the golf hole. After each putt and after the experimenter had retrieved the golf ball, the light was turned back on and participants were asked to estimate the distance to the hole and the size of the hole. After reporting both estimates, participants once again faced the back wall and the light was turned off as the materials were adjusted for the next trial.

Following the three practice trials was the main experiment, which consisted of 18 experimental trials. The procedure for the experimental trials was the same as for the practice trials, with one exception: within each group (experienced vs. novice golfers), participants were randomly assigned to either the evaluation condition or the no-evaluation condition. Those in the evaluation condition believed they were being
recorded and their performance would be evaluated, whereas those in the no-evaluation condition did not anticipate being recorded or evaluated.
CHAPTER III
RESULTS

There were three dependent variables in this study: distance estimates for each of the three target hole distances, size estimates for each of the three target hole diameters, and putting error for each of the three target hole distances.

**Distance estimates.** Averages were computed for distances estimates at each distance (six trials per distance). Distance estimates were analyzed using a 2 (experience) x 2 (evaluation) x 3 (target) mixed measures ANOVA. There was a significant interaction between experience and evaluation, $F(1,33) = 4.94, p = .03$ (See Table 1). In order to decompose this interaction, distance estimates were scaled by target distances to obtain a total-percent-of-distance-estimated score for each participant. A value above 100 indicated overestimation of target distance and a value under 100 indicated underestimation. These distance estimate accuracy scores were then used to test for simple effects. Although there was a significant experience x evaluation interaction, several simple effects approached significance. For golfers in the no-evaluation condition, the difference between novice and experience golfers’ estimates of distance approached significance, $F(1, 33) = 3.33, p = .08$ with novice golfers estimating the hole to be farther ($M = 121.27, SD = 25.99$) than experienced golfers ($M = 104.43, SD = 11.73$). However, in the evaluation condition, there was no difference between experienced ($M = 116.41, SD = 20.62$) and novice golfers ($M = 103.24, SD = 17.74$),
Among novice golfers, there was a trend toward more accurate estimates in the evaluation condition than in the no-evaluation condition, \( F(1, 33) = 3.31, p = .08 \). Experienced golfers in the evaluation condition did not estimate the targets differently than experienced golfers in the no-evaluation condition, \( F(1, 33) = 1.76, p = .19 \). There was a significant main effect of target distance, \( F(1.94, 39.26) = 203.37, p < .001 \); planned linear contrasts confirmed that distance estimates increased with actual target distance, \( F(1, 33) = 284.63, p < .001 \).

Table 1.

Mean and Standard Deviation of Distance Estimates for Each Level of Evaluation, Experience, and Putting Distance

<table>
<thead>
<tr>
<th>Puttting Distance</th>
<th>Experienced</th>
<th></th>
<th>Novice</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Evaluation</td>
<td>Evaluation</td>
<td>No Evaluation</td>
</tr>
<tr>
<td>3.00 m</td>
<td>3.15 (0.36)</td>
<td>3.16 (0.63)</td>
<td>3.53 (0.82)</td>
</tr>
<tr>
<td>4.50 m</td>
<td>4.71 (0.59)</td>
<td>5.37 (1.05)</td>
<td>5.69 (1.69)</td>
</tr>
<tr>
<td>6.00 m</td>
<td>6.22 (0.80)</td>
<td>7.43 (1.53)</td>
<td>7.18 (1.88)</td>
</tr>
</tbody>
</table>

Size estimates. Averages were computed for size estimates for each hole size (six trials per hole size). A 2 (experience) x 2 (evaluation) x 3 (target) mixed measures ANOVA showed that, contrary to what was predicted, there was no interaction between evaluation and experience, \( F(1, 33) = .06, p = .81 \). There was a significant main effect of
hole size, \( F(1.31, 43.32) = 486.45, p < .001 \); planned linear contrasts indicated that size estimates increased with increasing hole size, \( F(1, 33) = 533.61, p < .001 \) (See Table 2).

Table 2.

**Mean and Standard Deviation of Size Estimates for Each Level of Evaluation, Experience, and Hole Size**

<table>
<thead>
<tr>
<th>Hole Size</th>
<th>Experienced</th>
<th></th>
<th>Novice</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Evaluation</td>
<td>Evaluation</td>
<td>No Evaluation</td>
<td>Evaluation</td>
</tr>
<tr>
<td>7.62 cm</td>
<td>7.34 (0.82)</td>
<td>7.58 (1.28)</td>
<td>7.45 (1.96)</td>
<td>6.99 (0.95)</td>
</tr>
<tr>
<td>12.70 cm</td>
<td>13.24 (1.00)</td>
<td>13.16 (1.11)</td>
<td>12.48 (1.26)</td>
<td>12.42 (0.97)</td>
</tr>
<tr>
<td>17.78 cm</td>
<td>17.09 (1.29)</td>
<td>17.21 (1.88)</td>
<td>16.30 (2.61)</td>
<td>16.57 (1.82)</td>
</tr>
</tbody>
</table>

**Putting error.** A 2 (experience) x 2 (evaluation) x 3 (target) mixed measures ANOVA showed that, contrary to what was predicted, there was no interaction between evaluation and experience, \( F(1, 33) = .03, p = .86 \). However, there was a significant main effect of target distance, \( F(2, 66) = 27.70, p < .001 \). According to planned linear contrasts, putting error increased linearly with target distance, \( F(1, 33) = 54.41, p < .001 \) (See Table 3). There also was a significant main effect of experience with regards to putting error, \( F(1,33) = 7.14, p = .012 \). Experienced golfers displayed less putting error (i.e., putted closer to the hole) \((M = 1.67, SD = 1.11)\) than novice golfers \((M = 2.52, SD = 1.01)\). A three-way mixed-model ANOVA with hole size as a within-subject variable in place of hole distance showed that there was a main effect of hole size, \( F(1.77, 58.35) = \)
12.60, \( p < .001 \). Planned linear contrasts confirmed that error was greater for smaller holes than for larger holes, \( F(1, 33) = 15.87, p < .001 \) (See Table 4). There was also a main effect of experience, \( F(1, 33) = 7.32, p < .05 \). Novices displayed greater putting error \((M = 2.57, SD = 1.00)\) than experienced golfers \((M = 1.66, SD = 1.13)\).

Table 3.

*Mean and Standard Deviation of Putting Error for Each Level of Evaluation, Experience, and Putting Distance*

<table>
<thead>
<tr>
<th>Putting Distance</th>
<th>Experienced No Evaluation</th>
<th>Experienced Evaluation</th>
<th>Novice No Evaluation</th>
<th>Novice Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>3.00 m</td>
<td>1.22 (0.91)</td>
<td>1.30 (1.02)</td>
<td>1.99 (0.90)</td>
<td>2.22 (1.08)</td>
</tr>
<tr>
<td>4.50 m</td>
<td>1.56 (1.19)</td>
<td>1.88 (1.31)</td>
<td>2.36 (0.95)</td>
<td>2.63 (1.21)</td>
</tr>
<tr>
<td>6.00 m</td>
<td>1.79 (1.10)</td>
<td>2.17 (1.23)</td>
<td>2.74 (1.17)</td>
<td>3.42 (0.68)</td>
</tr>
</tbody>
</table>
Table 4.

*Mean and Standard Deviation of Putting Error for Each Level of Evaluation, Experience, and Hole Size*

<table>
<thead>
<tr>
<th>Hole Size</th>
<th>Experienced No Evaluation</th>
<th>Experienced Evaluation</th>
<th>Novice No Evaluation</th>
<th>Novice Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.62 cm</td>
<td>1.64 (1.03)</td>
<td>1.93 (1.11)</td>
<td>2.69 (0.93)</td>
<td>2.94 (0.84)</td>
</tr>
<tr>
<td>12.70 cm</td>
<td>1.68 (1.20)</td>
<td>1.85 (1.12)</td>
<td>2.47 (1.09)</td>
<td>2.97 (0.75)</td>
</tr>
<tr>
<td>17.78 cm</td>
<td>1.25 (1.06)</td>
<td>1.61 (1.15)</td>
<td>1.95 (1.03)</td>
<td>2.40 (1.41)</td>
</tr>
</tbody>
</table>

For heart rate, a 2 (experience) x 2 (evaluation) ANOVA showed no main effects or interactions. Although there was no main effect of experience on heart rate, $F(1, 33) = .84$, $p = .37$, heart rates were trending in the expected directions. Novices experienced a higher heart rate ($M = 90.70$, $SD = 12.16$) than experienced golfers ($M = 87.18$, $SD = 12.61$). In addition, although the main effect was not significant, $F(1, 33) = .42$, $p = .52$, those in the evaluation condition experienced a higher heart rate ($M = 89.96$, $SD = 14.27$) than those in the no-evaluation condition ($M = 87.69$, $SD = 10.52$).
Table 5.

Mean and Standard Deviation of Heart Rate (bpm) for Each Level of Evaluation and Experience

<table>
<thead>
<tr>
<th></th>
<th>Experienced</th>
<th></th>
<th>Novice</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Evaluation</td>
<td>Evaluation</td>
<td>No Evaluation</td>
<td>Evaluation</td>
</tr>
<tr>
<td>M (SD)</td>
<td>85.36 (11.19)</td>
<td>88.66 (14.02)</td>
<td>89.78 (9.99)</td>
<td>92.00 (15.54)</td>
</tr>
</tbody>
</table>
CHAPTER IV
DISCUSSION

This study resulted in a few interesting findings, of which the most notable was the experience-evaluation interaction in the opposite direction of what was expected for distance judgments. Novices perceived the hole as closer, whereas experienced golfers perceived the hole as farther away, in the presence of an evaluative audience. This suggests that the presence of an evaluative audience alters perception in a way that enhances novice performance and impairs skilled performance. These perceptual differences were found for distance judgments and not size judgments, however. These findings contrast with those of previous studies that performance is associated with perceptual differences (Wesp, Cichello, Gracia, & Davis, 2004; Witt & Dorsch, 2009). An explanation for the contradicting results could be that participants received performance feedback before giving their spatial estimates in the previous studies, whereas they did not receive any type of feedback in the current study. Had feedback been available to participants, experienced golfers should have perceived the golf hole as larger and closer while novices should have perceived the hole as smaller and farther away based on their performance. Although these findings contradict those of other perceptual studies, they are somewhat consistent with the reinvestment approach to social facilitation effects. Participants in the evaluative audience condition were told that their
performance would be recorded and the experimenter would take notes on their putting
technique, so it is reasonable to assume that participants became more self-focused. As
reinvestment research indicates, self-awareness, and specifically consciousness of the
task procedure, differentially impacts performance depending on the performer’s skill
level. Skilled performance suffers as a result of this self-awareness, whereas unskilled
performance improves. The fact that experienced golfers outperformed novices even with
altered distance perception that should have impaired their performance and enhanced
novices’ performance leaves open the possibility of an additional mechanism that can
explain performance differences under pressure.

The performance findings of this study partially support the concept of learned
drive as applied to sport performance. As expected, experienced golfers performed better
than novices in the presence and absence of an evaluative audience, as indicated by
putting error. However, if true learned drive effects had occurred, the presence of an
evaluative audience should have caused experienced golfers to perform better than they
performed in the absence of an evaluative audience, and novices to perform worse than
they performed in the absence of an evaluative audience. As putting error shows, this was
not the case. Within each experience group, putting error did not differ regardless of
evaluation condition. An explanation for this could be that the manipulation of pressure
(the presence of an evaluative audience) was not strong enough to induce strong social
facilitation effects. Perhaps presenting the experimenter who operated the video camera
as a golf expert rather than an observer would have induced stronger effects.

Finally, it was proposed that anxiety could account for perceptual differences
between experienced and novice golfers. The specific way in which an evaluative
audience influences task performance might be through heightened anxiety. Other research has shown that emotional arousal like fear can alter perception of spatial dimensions such as height (Stefanucci & Proffitt, 2009). Since anxiety can be cognitively, emotionally, and physically taxing, it is presumed that anxiety alters perception in a manner similar to fear. The presence of an evaluative audience could increase anxiety, which could lead to altered perception of the target and either enhanced or impaired performance. Given this notion that anxiety could explain perceptual differences between the two groups, it was expected that experienced golfers would have low anxiety across both evaluative conditions. It was also expected that novices would have greater anxiety than experienced golfers and greater anxiety in the presence of an evaluative audience than in the absence of an audience. Again, the findings partially support these hypotheses, with heart rates trending in the expected directions. Novices had a higher heart rate than experienced golfers in both evaluative conditions, and both novices and experienced golfers had a higher heart rate when evaluated than when not evaluated. One reason for these statistically non-significant findings could be that the manipulation of pressure was not enough to induce anxiety. Another reason could be that the assessment of heart rate was not entirely reliable. The heart rate monitor was connected via Bluetooth to a smartphone application that displayed the heart rate throughout the study. The majority of participants reported that they believed the cover story for the pressure manipulation, so the effects of this manipulation should have shown in the heart rate. Perhaps a different assessment of anxiety, such as galvanic skin response, would have been a more reliable measure of anxiety.
The manipulation of pressure may not have been enough to induce anxiety, but it appears that high anxiety is not necessary to cause misperception of a task target. Novice and experienced golfers still experienced perceptual differences when evaluated even though they experienced no significant difference in anxiety. This finding supports a prior finding that one may experience perceptual differences under low anxiety. Under conditions of low or no anxiety, participants who performed better in a dart-throwing task perceived the target as bigger than those who performed worse, whereas those under a condition of high anxiety did not differ in their size perception of the target (Canal-Bruland, Pijpers, and Oudejans, 2010).

There were multiple limitations of this study that may have impacted the overall findings. First, experienced golfers and novices encompassed a wide range of experience. Therefore, participants’ breadth of dominant responses and explicit knowledge of the task procedure was fairly large. Because a considerable number of participants fell within the median range of task experience, their results could have disguised the results of very experienced golfers and very inexperienced novices. A second limitation was the small participant pool from which experienced golfers were drawn. Since there were not enough university varsity team members to complete the experienced group, members from the club team were pooled. This resulted in a wide disparity of golf experience and therefore the amount of explicit knowledge of the task, both of which are crucial to learned drive theory and reinvestment in social facilitation. A third limitation of this study was that it focused on differences between novice and experienced golfers. These findings cannot explain performance differences among elite athletes who have the same level of task experience. A fourth limitation was the way in which the hole diameter,
distance from hole, and order of spatial judgment were randomized in the experimental trials. Ideally, participants were to experience each unique combination of these three variables one time, for a total of 18 trials. Randomization error resulted in some participants experiencing the same combinations multiple times while not experiencing other combinations at all. This could have been a factor in the mixed perceptual results, because size and distance estimates were dependent on the hole diameter and distance from the hole.

In addition to this study’s limitations that may have resulted in mixed support for the learned drive and reinvestment accounts of social facilitation, it is especially important to be aware of limitations of social facilitation studies in general. Given these various limitations, it is not alarming that findings are not entirely supported across studies. One limitation in this line of research is that the operationalization and classification of variables and how they are measured greatly varies across social facilitation studies. Therefore, both comparable and disparate findings should be carefully considered. It should be noted that some researchers use the term drive interchangeably with arousal, focusing on physiological indicators such as heart rate and palmar sweat, whereas others refer to drive as a hypothetical construct that is not typically operationalized. Drive was used synonymously with arousal/anxiety in this study. Participants experienced no significant differences in drive, but performance differences between novices and experienced golfers support the learned drive account. It could be that drive cannot be directly measured and anxiety is not the best representation of drive. Other disparities in studies include the expertise level of participants. The current study used a fairly coarse classification system to break down experienced and novice golfers,
whereas other studies apply more stringent operationalizations of experienced and novice participants. The mixed perceptual, performance, and anxiety findings could be a result of having no clear and strict classifications of novice and experienced golfers.

Assessment of drive and classification of participant expertise are only two factors that differ across studies and could potentially result in disparate findings. Other variable classifications that differ across social facilitation studies include task complexity, audience expertise, and manipulation of an evaluative audience. When considering all of these variables, it is apparent that few studies’ findings can be thoroughly compared with confidence. Factors that could easily impact results include: task complexity, sampling error, and the dependent variables assessed (Bond & Titus, 1983). Examples of common performance variables in social facilitation studies are quantitative (e.g. latency, completion time, response rate) and qualitative (e.g. errors, trials), and physiological arousal. The current study involved a quantitative performance assessment (measured putting error). Common anxiety assessments in social facilitation research include: galvanic skin response, palmar sweat, and heart rate, which was used in the present study. Despite disparities in social facilitation study designs, there are still many variables that can be compared and it is useful to consider the general research findings when applying learned drive theory and reinvestment to the present study’s findings.

The purpose of this study was to explain why some athletes choke under pressure whereas others do not. The proposed mechanism by which athletes’ performance suffers was altered perception of the task target due to the presence of an evaluative audience, via heightened anxiety. Given that the findings partially support this mechanism, more
research needs to be conducted in this area. In particular, future studies should focus on either clearly dividing experienced and novice groups so that there is no middle ground of task experience or treating experience as a continuous variable. Additionally, since participants experienced perceptual differences without heightened anxiety, future research should examine factors other than generalized anxiety as potential mechanisms for altering perception of the task-relevant stimuli in social facilitation. For example, future research could manipulate self-focus more directly. Directing participants to focus on the step-by-step task procedure might result in different findings than manipulating performance pressure in general. It is necessary to distinguish levels of this manipulation, as strong self-focus relates to reinvestment and general pressure relates to drive. A final consideration is to study differences only among an expert athlete population. The learned drive and reinvestment theories of social facilitation depend upon various levels of expertise. Yet even professional athletes “choke” or are “clutch” under pressure and constantly seek to improve their performance.

This study is beneficial to athletes seeking to enhance their performance under pressure. To date, no research has connected the concept of social facilitation to misperception in sports. This study demonstrated that experienced and novice performers may perceive visual-spatial information differently in a pressure situation. Given that social facilitation effects are present even among elite athletes who are considered very experienced at a sport, there must be more to social facilitation than what learned drive, reinvestment, and perceptual differences can explain. Future research must uncover this missing link, and its discovery will be essential to enhancing performance under pressure. This research will especially benefit athletes under tremendous amounts of pressure in
game situations. Athletes can apply these findings to gain a mental edge and get one step closer toward attaining their “perfect” game.
REFERENCES


APPENDIX

GOLF EXPERIENCE QUESTIONNAIRE

Note: The term "golf" in these questions excludes miniature golf.

1. Have you golfed competitively (on a club or school team)? If so, please describe.

2. Do you currently golf competitively? If so, please describe.

3. Approximately how often do you golf per year (play 9 or 18 holes competitively or non-competitively)?

4. Please rate your level of golf skill by circling your response on the following scale.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>unskilled</td>
<td>somewhat unskilled</td>
<td>neither skilled nor unskilled</td>
<td>somewhat skilled</td>
<td>skilled</td>
</tr>
</tbody>
</table>
Demographics

Age:  17  18  19  20  21  22+

Gender:  Male  Female

Year in School:  Freshman  Sophomore  Junior

                         Senior  Graduate Student