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Noah Perrin

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ASSESSING THE RELATIONSHIP BETWEEN AUDIENCE AND SPORT PERFORMANCE IN COMPETITION DURING THE COVID-19 PANDEMIC

By

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Abstract

The COVID-19 pandemic has created an environment in sports in which players are performing in the absence of crowds. This study analyzed the performance of 12 teams and 11 players in games played with and without an audience over a period of three years in collegiate basketball. It was expected that in games with crowds, simple tasks (free throws) would be more successful and complex tasks (field goals) would be less successful compared to games without crowds. The second hypothesis predicted that home performances would be better than away performances in seasons with crowds, but there would be no difference without crowds. The data showed mostly insignificant trends and inconsistent trends among the teams and individuals. There was a significant increase in simple task performance for individuals in the away setting from the first season with crowds to the second season without crowds which was unexpected. Additionally, there was only one significant home field advantage found in the player's simple task performance for the first season. Analysis of the teams and individuals showed that whether a task is facilitated or impaired in the absence of crowds varies among the participants. These findings provide insight into social facilitation in real competitions in which future studies using performances during the COVID-19 pandemic can build on.

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Assessing the Relationship Between Audience and Sport Performance in Competition During the COVID-19 Pandemic

Sport has always been social. Athletes push themselves to perfect their craft and get to the largest social gatherings. They prepare and hone their skills in order to execute their plays in front of crowds of spectators. Spectators socially identify with teams or individual players and play their own roles while they try to influence games from the stands (Wann & Hackathorn, 2019). The presence of others may activate arousal (Zajonc, 1965; Blacovich et al., 1999) or effect cognitive processes (Sanders et al. 1978; Baron, 1986, Carver and Scheier, 1981) that produce positive or negative results on performance. The complexity of the tasks as well as the characteristics of the audience influences social facilitation effects (Aiello & Douthitt, 2001).

While research looking into the theory of social facilitation dates to the 1890s (Triplett, 1898), little data has been analyzed from real-life sport competitions in the complete absence of crowds. In March 2020, the COVID-19 pandemic forced crowds out of athletic stadiums around the world. Researchers have already started to study performance in the "ghost games" of the COVID-19 pandemic (Blomqvist & Shaw, 2020; Fischer & Haucap, 2020; Bryson et al., 2020; Henrich et al., 2021). These ghost games provide a natural social experiment that can be used to further research on social facilitation in sport and performance. The first section of this paper reviews the literature that focuses on theories of social facilitation and the influence of task complexity and audience characteristics on spectator effects in performance. It also assesses the current state of literature on this topic during the COVID-19 pandemic.

Assessing Performance

Assessing performance and its psychological components is beneficial and important for professionals around the world in all fields such as business, sports, politics, and academics.

According to the APA, “Performance psychology is the study and application of psychological principles of human performance to help people consistently perform in the upper range of their capabilities and more thoroughly enjoy the performance process,” (APA Division 47, 2019, p. 9). Therefore, especially in the realm of sports psychology, performance must be assessed empirically to determine whether athletes are performing consistently to their capabilities.

Performance can be measured objectively or subjectively (Fram & Reichin, 2019). Objective measures analyze the success or failure of a certain task and uses the scores of individuals and teams. For example, researchers can measure baseball batting average (Smith & Christenson, 1995), basketball shooting percentage and number of offensive rebounds (McHill & Chinoy), and bowling scores (Woodman, Albinson, & Hardy, 1997). Subjective measures ask individuals such as players or coaches to subjectively rate the quality of an athlete’s performance. By using scales such as the Sport Satisfaction Instrument (Duda & Nicholls, 1992), researchers can tap into an athlete’s ability to analyze and gauge their satisfaction with their performances (Gaudreau & Blondin, 2004). This study utilized objective performance data. This type of data is reliable when assessing performance on specific tasks. The next section investigates the relationship between audience and performance.

Social Facilitation and the Influence of Audience on Performance

Social facilitation is a theory of social psychology that has been widely used to explain the impact of spectator presence on individual performance. Social facilitation research in sport psychology investigates performance variations in the presence of an audience compared to performing alone. Early work on social facilitation theory (Allport, 1920; Triplett, 1898) produced conclusions that individuals step up their performance when in the presence of others. Norman Tripplet, working in one of the oldest psychology labs in the United States in the late

1890s, is often credited for conducting some of the first sport psychology research studies, and many of his observations and experiments dealt with social facilitation (Aiello & Douthitt, 2001; Wann & Hackathorn, 2019). Triplett (1898) investigated cyclists racing alone versus racing with other cyclists, and he found that the presence of another contestant in a race "serves to liberate latent energy not ordinarily available," (p. 533). A second study by Triplett showed that a child, when placed in the presence of another child, will wind a machine like a fishing rod at a faster pace. Triplett concluded in his studies that the presence of others enhances performance through the stimulation of a competitive instinct. More than a century later, Strube (2005) analyzed the results of Triplett's winding machine study using modern statistical methods and concluded that Triplett's data did not show statistically significant differences in performance. However, as the 20th century started Triplett's findings were championed and fueled further research valuable to social psychology, sport psychology, and the social facilitation theory.

Two decades after Triplett's pioneering work on social facilitation, Floyd Allport (1920) coined the term "social facilitation." Unlike Triplett's work that induced performance effects through fellow competitors, Allport designed experiments that isolated the social influences of mere presence of others on individual performance. Allport had his participants do mental tasks such as word association both in groups and alone. He observed that under a group setting, people created more associations than when alone. However, the quality of associations was better in the alone setting. Allport's experiments expanded the theory and inspired future psychologists to investigate not only how social facilitation improves performance, but how it may work as an impairment. One of these psychologists, Robert Zajonc, would develop a model that further clarifies the complex phenomenon of social facilitation.

Drive Theories of Social Facilitation

In the middle of the 1960s, another breakthrough in social facilitation research took place. Robert Zajonc wrote his seminal article in 1965 where he brought the focus of social facilitation on to the kinds of tasks being performed. Zajonc integrated drive theory in his model of social facilitation; proposing that social presence of any kind causes increased arousal in performers. Increased arousal, in turn, leads to the increase of the performance of dominant responses or the most probable response to a certain task. By utilizing the classical learning theory, he postulated that the dominant response of a complex task will be incorrect for a beginner in initial learning and correct for an expert who has already mastered the task. If a task is easy, the dominant response is likely to be correct, and therefore, performance under social presence is likely to be facilitated. This model accounts for the array of articles showing facilitation and impairment of performance under social presence (Aiello & Douthitt, 2001).

Research using Zajonc's drive perspective has generally supported his hypothesis. Martens (1969) performed laboratory studies examining effects of the audience on the performance of complex motor skills, and he found support for Zajonc's theory. Additionally, future reviews of drive theory research continued to support the hypothesis that dominant responses are facilitated in the presence of others more than when alone, and performance depends on whether the dominant response is adequate (Geen, 1989; Geen & Gange, 1977).

Subsequent theories sought to investigate what was driving the arousal during social facilitation. Blascovich et al. (1999) utilized advanced technology to measure cardiovascular responses of participants performing well-learned and unlearned tasks. They argue that a well-learned task presents a challenge which occurs when the performer has the resources necessary to meet the demands of the task. An unlearned task presents a threat. Threat occurs when the

performer does not have the resources necessary for what the task demands. They argue that the cardiovascular system is attuned to respond differently to challenges and threats. They found participants performing well-learned tasks showed increased cardiac response and decreased vascular resistance while those performing unlearned tasks showed increased cardiac response and increased vascular resistance. While the increased cardiac response in both tasks improves cardiac performance, the decreased vascular resistance in the well-learned task promotes the mobilization of energy for coping. While well-learned tasks were not affected by the audience presented in the study, the unlearned tasks performed worse in the presence of an audience than when alone. The results formed a biopsychosocial model of challenge and threat that could be integrated into Zajonc's social facilitation theory.

Other theories like Cottrell's (1972) evaluation apprehension theory posit that drive is learned through experience with certain social situations and how individuals come to associate specific social situations with certain consequences. According to Cottrell, arousal levels increase only when individuals are concerned about how others would evaluate them. Baumeister (1982) proposed a similar theory. He proposed that the presence of spectators creates a desire in an individual to please the audience and create an optimal public image of themselves that reflects their ideals. He explains that while the mere presence of others produces drive, the evaluative presence of others is even more important. If a spectator has an evaluative presence, they may be a judge, scout, coach, or teammate with the knowledge to critique performance, while a spectator low on evaluative performance would not have the knowledge to assess performance. Someone considered to be evaluative would produce more drive compared to someone considered to be non-evaluative.

Cognition and Attention Theories

While drive theories focus on levels of arousal among performers, several theories have been proposed on how certain attention and cognition processes are affected by the presence of others in the performance of tasks. In 1904, Meumann found that actors become distracted by the presence of others and the attention to tasks was corrupted. Sanders et al. (1978) hypothesized that this distraction hinders performance and increases arousal, which is fueled by the conflict the performer faces while trying to pay attention to their task and the crowd. Sanders et al. (1978) used nonsocial distractors in their study to prove their distraction-conflict hypothesis.

Baron (1986) modified the distraction-conflict hypothesis by proposing that the distraction conflict does not activate arousal but causes a cognitive overload that leads to attentional exhaustion. Complex tasks demand attention to a large set of stimuli and added distraction from spectators creates cognitive overload and a decrement in performance. However, since simple tasks are known to be optimally performed by focusing on relevant stimuli, the cognitive overload caused by spectators' forces performers to disregard irrelevant stimuli that usually impede performance, and performance is enhanced. Huguet et al. (1999) used Stroop tasks to support Baron's (1986) overload hypothesis.

Another theory that focuses on attention is Carver and Scheier's (1981) feedback-loop model. Carver and Scheier (1981) suggest that the self-awareness induced by the presence of others creates a disparity between an ideal behavior in which the performer has a standard for performance and the actual behavior that is affected by an increase in self-awareness. The individual works to reduce this discrepancy through feedback loops that continually compare and correct action-control processes to close the gap between the ideal and actual behaviors. Eventually, the individual chooses a process that works and produces their ideal standard.

However, in the case of complex or unlearned tasks, the standard is not yet set which makes it harder to produce optimal reactions to the task.

Important Variables in Social Facilitation

Social facilitation has been complicated further by findings that show results vary depending on the variables studied (Feltz & Kontos, 2002). Three main variables have been demonstrated by researchers to moderate the impact of presence on performance: task complexity, evaluation context, and type of presence (Aiello & Douthitt, 2001). This study examined task complexity and characteristics of presence.

Task Complexity and Performance

Task complexity is a popular aspect of theories on social facilitation. Research on social facilitation in sports psychology can take advantage of the variance between beginner and expert to study differences in spectator effects on learned and unlearned tasks. For example, Kotzer (2007) found that in front of an audience, expert basketball players made more free throws than when they were alone compared to novice players. Tanaka and Sekiya (2010) used a similar method by assessing performance and movement kinematics in expert and novice golfers under pressure conditions involving spectators, but they found no differences in performance or kinematics; noting that the stress induced in their study was relatively low compared to real sport situations. Kay and Martens (2015) operationalized skill level in real sport competitions by measuring the experience of teams as the number of minutes the players on each team had played in the NBA. They also utilized betting sport books to find which team was favored or an underdog. They found that underdog teams performed significantly better with large audiences and less experienced teams performed significantly better in nationally televised games than in locally televised games. Böheim et al. (2019) separated players by their past conversion rate in

free throws; estimating the effect audience size has on NBA free throws by separating the players who have a conversion rate in the lower 25th percentile and in the upper 25th percentile. Böheim et al. (2019) found a significant negative effect of attendance on performance for worse players on the home teams while no effect was seen on players with the highest conversion rate. Some of these results run contrary to the social facilitation hypothesis while others support or show no differences. However, characteristics of presence such as home and away or differences of skills such as golf and basketball are factors that influence the results of social facilitation studies and should also be considered.

Another important way to measure task complexity is to compare different skills in sport performance. In Aufenanger's (2005) analysis of competitive anxiety in athletes, she divides athletes into two categories; open and closed skilled athletes. Open skilled sports are mainly made up of team sports with an environment that is changing in which athletes must adapt and compete with a group, while close skilled sports are usually individual sports that allow for consistent and predictable settings (Fischman & Oxendine, 1998). A controlled setting allows athletes in close skilled sports to master a certain task and easily habituate a dominant response to a simple environment. Open and close skills can also be separated among different tasks within a sport. For instance, a penalty shot in soccer (Dohmen, 2008), cross country skiing in biathlon (Henrich et al., 2021), and the free throw in basketball (Kotzer, 2007) can all be seen as closed or simple tasks while shots on goal in soccer, rifle-shooting in biathlon, and field goals in basketball can be viewed as their open or complex task counterparts. This study utilized the different set of tasks within basketball.

In a meta-analysis of 241 studies on social facilitation, Bond and Titus (1983) concluded that the presence of others increases the speed of simple task performance and decreases the

speed of complex task performance, and the presence of others impairs complex performance accuracy and slightly facilitates simple performance accuracy. Whether a task is complex or simple depends on the experience of the performer as well as the nature of the skill being performed.

Characteristics of Social Presence

The characteristics of social presence will not always be constant and aspects of presence such as density/size of crowds, aggressive/encouraging cheering, or home/away settings can have significant effects on the relationship between audience and performance. Zajonc (1980) asserts that while characteristics of an audience can vary the significance of the audience's effect on performance, even when these situations are ruled out, social facilitation still takes place in the "mere" presence of an individual. The presence of an individual may have inherent effects on a performer, but those effects can be differentiated by the characteristics of the presence.

A well-known phenomenon in sports is the home field advantage. Sport psychology research has supported that home teams have an advantage over visiting teams. In a meta-analysis on home field advantage in which Jamieson (2010) included 87 studies investigating the phenomenon, data showed that home teams won 60% of competitions. In an overview of studies on the advantage of playing at home, Nevill and Holder (1999) concluded that "the evidence from studies investigating crowd factors appeared to provide the most dominant causes of home advantage," (p. 1). Studies assessing home field advantage have looked at both crowd size and crowd density as crowd factors that impact performance. Crowd density has been shown to be a greater predictor of home field advantage than crowd size (Agnew & Carron, 1984; Dawson & Dobson, 2010; Gouamos, 2014). When crowds are more tightly packed, a home player's performance is superior to away players.

The largest home field advantage is seen in indoor sports (Schwartz & Barsky, 1977) where sound from the crowd can be heard easier. Noise from crowds can have different characteristics, ranging from supportive cheers to aggressive jeers. Wann and Hackathorn write those spectators have three available options when trying to assist their teams: instrumental aggression, encouraging statements, and superstitious actions (2019). While superstitious actions are unlikely to affect performers, instrumental aggression (performing acts that are intended to physically or psychologically harm another) and encouraging statements (verbal encouragements intended to motivate performers) can impose advantages and disadvantages to the performance of home and away players.

Epting et al. (2011) provide an example of a study that investigated the relationship of "Cheers vs. Jeers." Their study introduced either a cheering, jeering, or silent audience to college baseball, basketball, and golf athletes. Results showed that basketball free throw performance was not influenced, jeering decreased performance in baseball pitchers, and cheers decreased performance for golfers. The difference in tasks between the sports might have driven the differences in performance changes, but nevertheless, the behavior of the audience did have significant effects on athletes.

Real-Life Implications from COVID-19

Sport and performance psychology research plays an important role in helping professionals perform at their best in high pressure situations. To gain knowledge on what is happening during these situations, researchers test athlete's abilities to perform under pressure in sport competitions with considerably large direct or indirect television audiences (Geukes et al., 2013). Experimental research manipulating pressure conditions has mainly taken place under private laboratory-based conditions (Ogawa & Sekiya, 2016; Hasegawa et al., 2013; Mesagno et

al., 2011; Wright, 2015) where on top of audience presence, motivational factors such as money incentives and prizes have also been used.

However, researchers have attempted to use real competitions by measuring characteristics of audiences such as the crowd size (Crewther et al., 2020; Kay & Martens, 2015; Böheim et al., 2019) and density (Russell, 1983). Russel (1983) found that crowd size was negatively related to performance of visiting teams while crowd density was negatively related to the performance of both teams in a junior hockey league. Crewther (2020) found that crowd size was positively related with four out of eight performance indicators while the others showed no significance in the International Rugby Union. As discussed before, research on home field advantage has shown that crowd density positively influences home team performance (Jameison, 2019).

A main difference between laboratory settings and real competitions is the existence of home versus away factors. Measuring the effects of supportive and unsupportive audiences in real competitions is as easy as researching home and away games while measuring the effects of no audience and audience in real competitions would take an unusual social situation that takes spectators out of the crowds altogether. Past research in real competitions used crowd size to study social facilitation in athletes, but these studies analyzed relatively small disparities in crowd size, and therefore, were not able to investigate Zajonc's (1965) claim that mere presence creates social facilitation effects. Unfortunately, the COVID-19 global pandemic created a situation in which athletes on a variety of levels (high school, collegiate, and professional) are playing in front of a drastically small number of spectators. This gives researchers an opportunity to make up for the minimal amount of research in social facilitation done on real competitions.

Current Literature Utilizing the COVID-19 Pandemic

On March 11, 2020, the National Basketball Association (NBA) lead the way in sports in United States by suspending their season (ESPN, 2021). Four months later, on July 7th, the first NBA player arrived at "the bubble." The NBA bubble was a highly controlled environment on the Disney world campus in which the top teams finished the season out playing in empty gyms (ESPN, 2020). What ensued was a year of athletes around the world playing in "ghost games;" creating a natural experiment for researchers in which athletes played in the absence of crowds (Fischer & Haucap, 2020).

In 1993, Moore and Brylinsky were the first to utilize an epidemic of an infectious disease to observe differences in performance without the presence of a crowd. A measles epidemic caused 11 college basketball games in the North Atlantic Conference between two teams to be played without spectators. They found support for improved performance in the absence of crowds using observed differences, effect sizes, and medians as reference points, but their t-test analysis showed no support for performance differences. While the researchers explain that there is some support for replication of their findings in the context of their limited data set, they acknowledge that researchers will have to wait for future misfortunes.

Moore and Brylinsky's paper served as a small-scale base for the unfortunately large scale of the COVID-19 pandemic. Some research has already been published utilizing the pandemic to evaluate performance. Several have focused on the phenomenon of home advantage during the pandemic. Tilp and Thaller (2020) evaluated games without audiences and games with audiences in the 2020 German soccer Bundesliga season compared to games in the previous 2019 season. They found significant differences in home advantage (HA) between games with an audience (HA = 54%) and games without an audience (HA = 44.1%) as well as games from the

previous 2019 season (HA = 57.63%). Without an audience, home field advantage disappeared, and home field disadvantage took its place. Fischer and Haucup (2020) found similar evidence of home field disadvantage in the German soccer league, but only in the first division; the top division out of the three divisions analyzed. Because the decrease in occupancy rates was most dramatic in the top division, they concluded that low occupancy rate explained the change in home advantage more suitably than other variables such as performance, location, and team variates. Jimenez and Lavin (2021) also found that HA was only affected in German and Spanish top leagues.

Several of the articles looking at home field advantage during the pandemic found that referees hand out less red and yellow cards in the absence of crowds at home (Tilp & Thaller, 2020; Bryson et al., 2020); indicating a social facilitation effect on referees that has been observed in past research (Dohmen & Sauermann, 2016). Bryson et al. (2020) suggest that since score lines were not significantly different without fans, referee bias may be the mechanism behind change in homefield advantage. Shaw and Blomqvist (2020) investigated MMA fights from 86 fighters in the pandemic compared to past competition history and found in the 586 bouts analyzed those fighters who won their bouts with no audience present consistently performed significantly poorer than their bouts with an audience. Since this research has shown impaired performance only in winners of MMA fights and top soccer leagues, this may be due to these populations being higher skilled athletes. According to social facilitation theory, a higher skilled athlete with more correct dominant responses will experience more facilitative effects in the presence of spectators.

Another phenomenon worth noting is the gender-specific audience effects found in Henrich et al. (2021). The researcher’s looked at the results of biathlon competitions in 2020

during the absence of crowds due to COVID-19 and 2018/2019 during the presence of crowds. Studying biathlon performance allows for the analysis of different tasks. Cross country skiing was assessed as a simple conditioning task while rifle-shooting was assessed as a complex coordination task. They used gender as an additional factor and found that in the presence of an audience, males performed better on the conditioning task and worse on the coordination task. Female athletes showed the reverse pattern. These results suggest that things like stereotype threat and sex differences may cause different social facilitation effects across genders.

While the presence of crowds may be affecting the arousal levels and cognitive abilities in athletes competing during the COVID-19 pandemic, the isolation, fear, and anxiety surrounding the disease itself may be having its own effects on the athletes. Mehrsafar et al. (2021) assessed the psychophysiological responses of 90 male professional football players 15 minutes before an official competition in the Football Federation of Iran without spectators. The measurements included the Fear of COVID-19 Scale, the Coronavirus Anxiety Scale, the Competitive State Anxiety Inventory-2, salivary alpha-amylase (sAA) and salivary cortisol (sCort). They found a significant correlation between COVID-19 anxiety and somatic competitive anxiety, cognitive competitive anxiety, and Scort and SAA responses. Therefore, the COVID-19 pandemic, disregarding crowd changes, is having its own impact on physiological arousal and cognitive anxiety in athletes. Di Fronso et al. (2020) used data on perceived stress and psychobiosocial states taken before the COVID-19 pandemic and compared it with data collected during the COVID-19 pandemic on 1132 Italian athletes. Their findings suggested that the pandemic increased the perceived stress and dysfunctional psychosocial states of athletes. Consequently, while we do find ourselves in a natural experiment, the physical and psychological stresses of the COVID-19 pandemic are other important variables to consider. As

a further example, Mon-Lopez et al. (2020) found that the COVID-19 isolation period caused reductions in sleep quality, training volume, and intensity. They add that psychological factors affected all these training and recovery conditions. This complex and novel environment is still influencing many factors in athlete's lives.

Current Study

The purpose of the current study was to analyze performance statistics in real game situations in competitions played with and without an audience during the COVID-19 pandemic. Previous studies have used laboratory conditions or field experiments to generalize social facilitation effects, but the goal of this study is to build upon this literature by adding to the small set of research that have utilized the natural experiment of empty stadiums during the COVID-19 pandemic. During the 2020-2021 NCAA D1 basketball season, games were played "with zero or limited capacity attendance" ("Attendance Records," 2021, p. 2). Given that college basketball statistics are extensively recorded and easily available, these games provide data that can be useful for scientific study.

The key variables in the current study are task complexity and home/away settings. Task complexity is broken down into simple and complex tasks. Free throw percentage represents a simple task while field goal percentage represents a complex task. Free throws are easily practiced gameplay situations compared to field goals which represents the array of different shooting situations in basketball. The performance of these tasks was measured in relation to all games and measured separately in home and away settings to investigate the role that game location plays in social facilitation. In the results section, teams and individuals are analyzed as groups. In the exploratory analysis, the teams and individuals are assessed individually to compare with trends in the group data.

This study included two hypotheses. The first hypothesis was that in games with crowds, simple tasks will be more successful and complex tasks will be less successful compared to games without crowds. The second hypothesis was that the performance of athletes will be better in-home games compared to away games when there are crowds. However, no difference will be observed in home and away games when crowds are absent.

Method

Participants

The sample for this study consisted of 12 teams in a Division 1 NCAA basketball conference and 11 players within these teams. The individual players were chosen by taking the top scorer from each team in the 2020-2021 season that had recorded at least 70 field goal attempts and 25 free throw attempts in each of the 2019-2020 and 2020-2021 seasons for the same team. Additionally, the individuals had to be currently participating in the 2021-2022 season for the same team as the two prior seasons. One of the 12 teams did not have a player that met the inclusion criteria, so the sample included 11 players, all representing a different team. Each chosen player ended up completing the 2021-2022 season and had at least 80 field goal attempts and 10 free throw attempts in the season.

Data Collection

The NCAA basketball regular season starts in November and ends in March the following year. Therefore, seasons span two different years and are referred to as being in both years. The data in this study is referred to as the 2019-2020, 2020-2021, and the 2021-2022 seasons in which the first year represents the start of each season.

The data in this research was collected from sports-reference.com. The team data was gathered from that team's individual page on the website. Furthermore, each player had their

own page and data was gathered in the same manner. Team and player names are not used to protect privacy.

Results

Team Findings

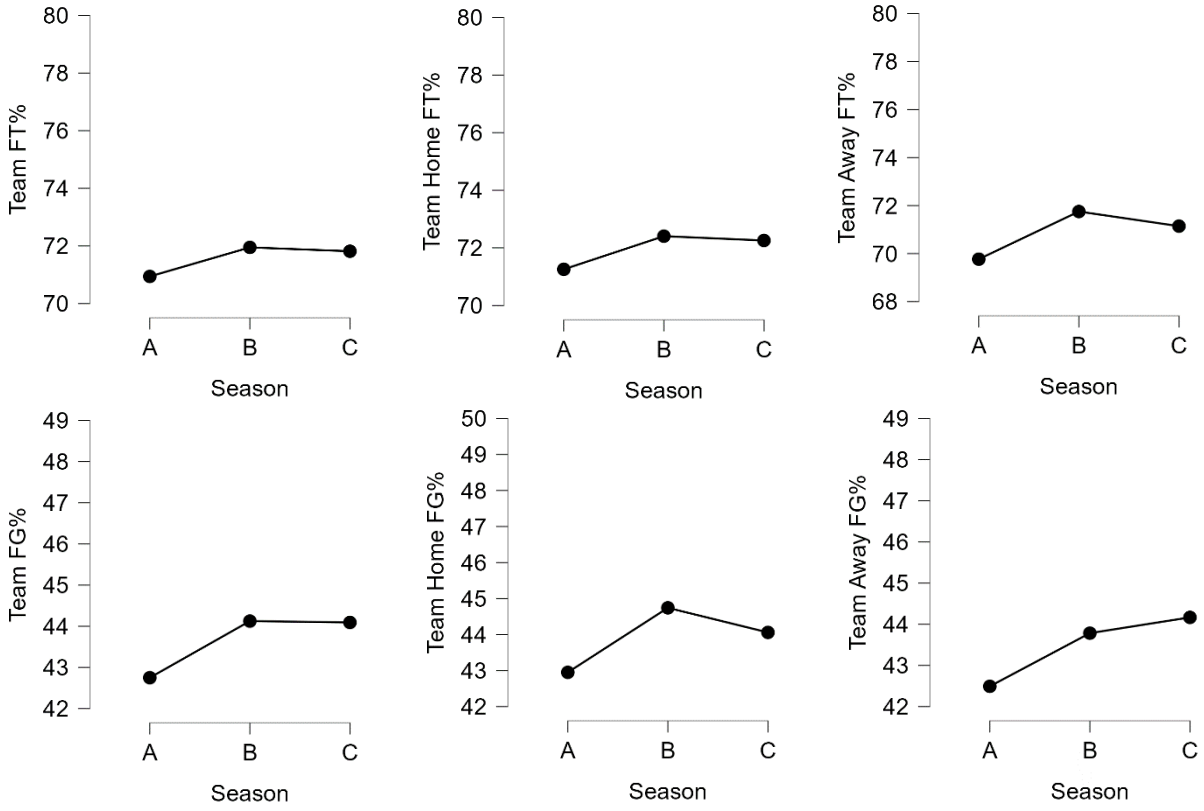
Descriptive Statistics

Figure 1 provides descriptive plots of the average task performance percentage for each season (A = 2019-2020, B = 2020-2021, and C = 2021-2022). The data for each point represents the mean of the total season task percentage for all the teams. Therefore, point A in the Team FT% graph represents the mean of the 12 total season free throw percentages for each team. The data for field goal percentage only reflects conference play. While free throws are performed in the absence of defenders, field goal performance may vary depending on the skill level of the defender. Using conference gameplay for the field goal analysis works to control the skill level of the defender because conferences in NCAA D1 basketball are made up of teams that are similar in skill level, but the level of play changes from conference to conference.

Observations from the descriptive plots suggest that Team FT% (simple task) and Team FG% (complex task) show similar trends. Both trend upward from A to B and appear to flatten into season C. Further analysis using ANOVA for each condition helped determine the significance of these results.

Figure 1

Team Task Performance Plots



Note. A = 2019-2020 season, B = 2020-2021, C = 2021-2022, FT = Free Throw, FG = Field Goal.

Table 1 provides the means of the home and away statistics on each task for each season. Observations of differences between home and away do not present apparent differences. For example, in season C, the difference between field goal percentage at home (M = 44.1, SD = 3.1) and away (M = 44.2, SD = 2.6) is miniscule. The largest difference is shown in home (M = 71.3, SD = 5.3) and away (M = 69.8, SD = 5.6) free throw performance in season A. Further analysis using paired t-tests determined the significance of these results.

Table 1

Team Home vs. Away Descriptive Values

Free Throw	AHomeFT	BHomeFT	CHomeFT	AAwayFT	BAwayFT	CAwayFT
Valid	12	12	12	12	12	12
Missing	0	0	0	0	0	0
Mean	71.3	72.4	72.3	69.8	71.8	71.1
Std. Deviation	5.3	6.7	3.9	5.6	5.4	4.9
Minimum	60.3	59.6	66.6	60.2	63.5	64.9
Maximum	79.7	80.5	77.0	75.8	79.2	81.4
Field Goal	AhomeFG	BHomeFG	CHomeFG	AAwayFG	BAwayFG	CAwayFG
Valid	12	12	12	12	12	12
Missing	0	0	0	0	0	0
Mean	43.0	44.7	44.1	42.5	43.8	44.2
Std. Deviation	2.6	3.0	3.1	2.4	3.2	2.6
Minimum	38.7	39.3	39.3	38.2	39.4	39.5
Maximum	47.8	50.7	50.1	45.7	49.8	49.6

Note. A = 2019-2020 season, B = 2020-2021, C = 2021-2022, FT = Free Throw Percentage, FG = Field Goal Percentage.

Repeated Measures ANOVA Analysis

Table 2 provides ANOVA results for each condition, comparing the means of the three seasons. For each condition, the *p*-value is greater than 0.05, concluding that the small changes observed in the descriptive plots between seasons of crowds and without crowds are not statistically significant. These results reject our hypothesis that simple task performance will be better with crowds and complex task performance will be better without crowds.

Table 2
Repeated Measures ANOVA - Team Findings

Condition	Cases	Sum of Squares	*df*	Mean Square	*F*	*p*
Team FT%	Season	7.20	2	3.60	0.28	0.76
	Residuals	281.63	22	12.80		
Team Home FT%	Season	9.38	2	4.69	0.22	0.80
	Residuals	460.56	22	20.94		
Team Away FT%	Season	24.78	2	12.39	0.60	0.56
	Residuals	456.73	22	20.76		
Team FG%	Season	14.77	2	7.38	2.61	0.10
	Residuals	62.35	22	2.83		
Team Home FG%	Season	19.62	2	9.81	1.76	0.20
	Residuals	122.89	22	5.59		
Team Away FG%	Season	18.48	2	9.24	1.29	0.30
	Residuals	158.18	22	7.19		

Note. Type III Sum of Squares. FT = Free Throw. FG = Field Goal.

Paired T-Test Results

Table 3 provides paired t-test results comparing performance of teams in home and away settings. More specifically, each season's home data are being compared to the same season's respective away data. We hypothesized that athletes would perform better at home games compared to away games when there was an audience, but there would be no difference when there was no audience. The t-test results did not support our hypothesis. All the t-test results are nonsignificant, concluding that there was not a significant difference in free throws or field goals in home or away settings for any of the conditions.

Table 3

Team Paired Samples T-Test

Measure 1	Measure 2	*t*	*df*	*p*
AHomeFT	AAwayFT	0.84	11	0.42
BHomeFT	BAwayFT	0.51	11	0.62
CHomeFT	CAwayFT	0.69	11	0.50
AhomeFG	AAwayFG	0.36	11	0.72
BHomeFG	BAwayFG	0.85	11	0.42
CHomeFG	CAwayFG	-0.12	11	0.91

Note. Student's t-test. A = 2019-2020 season, B = 2020-2021, C = 2021-2022, FT = Free Throw Percentage, FG = Field Goal Percentage.

Individual Findings

Descriptive Statistics

Figure 2 provides descriptive plots of the average task performance percentage for each season (A = 2019-2020, B = 2020-2021, and C = 2021-2022). The data for each point represents the mean of the total season task percentages for all the individuals. Therefore, point A in the Ind FT% graph represents the mean of the 11 total season free throw percentages for each individual (Ind). Ind FG% is calculated similar to Ind FT%, except that it only includes conference gameplay.

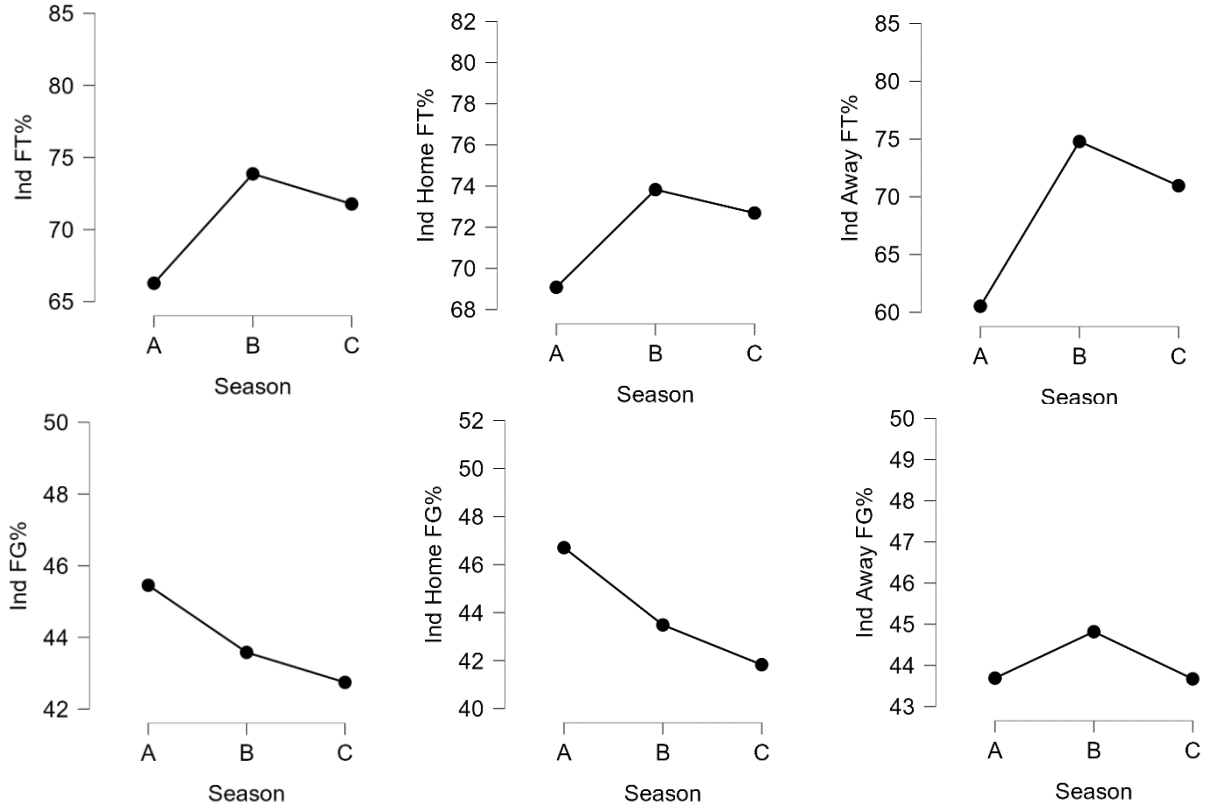
From season A to B, free throws improve in performance. Furthermore, in each free throw plot, performance slightly decreases from seasons B to C. This follows a trend similar to the team plots in which performance differences from seasons B to C were slight compared to performance differences from A to B.

Observations from the field goal plots show a decrease in field goal performance from seasons A to B in the overall field goal percentage and the home field goal percentage, but not in the away field goal percentage. Additionally, field goal percentage decreases slightly in each

chart from seasons B to C, following the same trend in the free throw plots. Further analysis using ANOVA for each condition determined the significance of these trends.

Figure 2

Individual Task Performance Plots



Note. A = 2019-2020 season, B = 2020-2021, C = 2021-2022, FT = Free Throw, FG = Field Goal, Ind = Individual.

Table 4 provides the means of the home and away statistics on each task for each season. Observations of differences between home and away for free throws in seasons A and B appear to support our hypothesis that home field advantage will disappear in the absence of an audience. By comparing home free throw performance for season A (AhomeFT) (M = 69.1, SD = 14.1) and away free throw for the same season (AAwayFT) (M = 60.5, SD = 12), the data shows an 8.6-point difference in favor of home settings. This large difference disappears in season B in which

away (*M* = 74.8, *SD* = 13.2) outperforms home (*M* = 73.8, *SD* = 9.6) by 1 point. In season C, there is a slight home field advantage again. Field goals show a similar trend for season A to B, but in season C, away outperformed home. Further analysis using paired t-tests determined the significance of these results.

Table 4

Individual Home vs. Away Descriptive Values

Free Throw	AHomeFT	BHomeFT	CHomeFT	AAwayFT	BAwayFT	CAwayFT
Valid	11	11	11	11	11	11
Missing	0	0	0	0	0	0
Mean	69.1	73.8	72.7	60.5	74.8	71.0
Std. Deviation	14.1	9.6	9.7	12.0	13.2	12.0
Minimum	41.9	55.6	56.2	45.2	56.2	50.0
Maximum	91.4	88.9	85.0	85.7	100.0	90.2
Field Goal	AHomeFG	BHomeFG	CHomeFG	AAwayFG	BAwayFG	CAwayFG
Valid	11	11	11	11	11	11
Missing	0	0	0	0	0	0
Mean	46.7	43.5	41.8	43.7	44.8	43.7
Std. Deviation	8.2	5.2	8.8	13.6	6.0	4.7
Minimum	37.3	34.2	22.4	23.9	36.1	36.5
Maximum	68.2	51.7	52.2	73.7	59.2	52.1

Note. A = 2019-2020 season, B = 2020-2021, C = 2021-2022, FT = Free Throw Percentage, FG = Field Goal Percentage.

Repeated Measures ANOVA Analysis

Table 5 provides ANOVA results for each condition, comparing the means of the three seasons. The *p*-values of every condition except for Individual Away FT% are greater than 0.05, indicating that the visual trends observed in the graphs are non-significant. Therefore, the results are not significant enough to conclude that there are any trends supporting our task complexity hypothesis. In the exception of Individual Away FT%, the ANOVA revealed that there was a significant difference among seasons A, B, and C for free throw percentage in away settings *F*(2,

20) = 4.65, $p < .05$. Post hoc tests (using the Holm correction to adjust p) indicated that the only significant difference among the seasons was a greater performance in season B without crowds (M = 74.8, SD = 13.2) than the season before (A) with crowds (M = 60.5, SD = 12), $t(20) = 2.95$, $p = .03$, 95% C.I [1.61, 26.9], $d = .89$. These results suggest that when crowds were removed in the 2020-2021 season, free throw performance was facilitated for away games. This rejects our hypothesis that simple tasks will be facilitated by crowd presence and supports the opposite. Furthermore, it suggests that the effects of crowds on free throw performance may be stronger in away settings than home settings. While these findings occur again in comparisons between season B to C, they are much weaker and non-significant which dilutes these conclusions.

Table 5
Repeated Measures ANOVA - Individual Findings

Condition	Cases	Sum of Squares	*df*	Mean Square	*F*	*p*
Ind FT%	Season	338.23	2	169.11	2.54	0.10
	Residuals	1331.88	20	66.59		
Ind Home FT%	Season	135.07	2	67.53	0.75	0.49
	Residuals	1799.89	20	89.99		
Ind Away FT%	Season	1197.42	2	598.71	4.65	0.02
	Residuals	2575.50	20	128.78		
Ind FG%	Season	42.34	2	21.17	0.73	0.50
	Residuals	583.74	20	29.19		
Ind Home FG%	Season	135.07	2	67.54	2.05	0.16
	Residuals	660.41	20	33.02		
Ind Away FG%	Season	9.47	2	4.74	0.08	0.93
	Residuals	1264.78	20	63.24		

Note. Type III Sum of Squares. FT = Free Throw. FG = Field Goal.

Paired T-Test Results

Table 6 provides paired t-test results comparing performances in home and away settings in each respective season. AHomeFT represents mean home free throw percentage in the 2019-2020 season and is being compared to the same season's away free throw percentage (AAwayFT). Each p-value is greater than 0.05, indicating non-significant differences, except for

the comparison between AHomeFT and AAwayFT. Therefore, there is no instance of significant differences between home and away performance for field goals or free throws, except for in the 2019-2020 season with crowds in which free throws performed better at home (M = 69.1, SD = 14.1) than away (M = 60.5, SD = 12), $t(10) = 2.62$, $p < .05$, 95% C.I [1.27, 15.84], $d = .79$. This significant home field advantage in simple tasks disappeared the next season and failed to return in 2021-2022 with crowds again. Therefore, the occurrence of home field advantage in season A with crowds, and its disappearance in season B without crowds supports our hypothesis that home field advantage will be observed with an audience but will disappear without one. However, the failure to return to significant home field advantage in season C rejects our hypothesis because home field advantage did not return when crowds appeared again in 2021-2022.

Table 6

Individual Paired Samples T-Test

Measure 1	Measure 2	*t*	*df*	*p*
AHomeFT	AAwayFT	2.62	10	0.03
BHomeFT	BAwayFT	-0.22	10	0.83
CHomeFT	CAwayFT	0.59	10	0.57
AhomeFG	AAwayFG	1.25	10	0.24
BHomeFG	BAwayFG	-0.74	10	0.48
CHomeFG	CAwayFG	-0.68	10	0.51

Note. Student's t-test. A = 2019-2020 season, B = 2020-2021, C = 2021-2022, FT = Free Throw Percentage, FG = Field Goal Percentage.

Exploratory Analysis

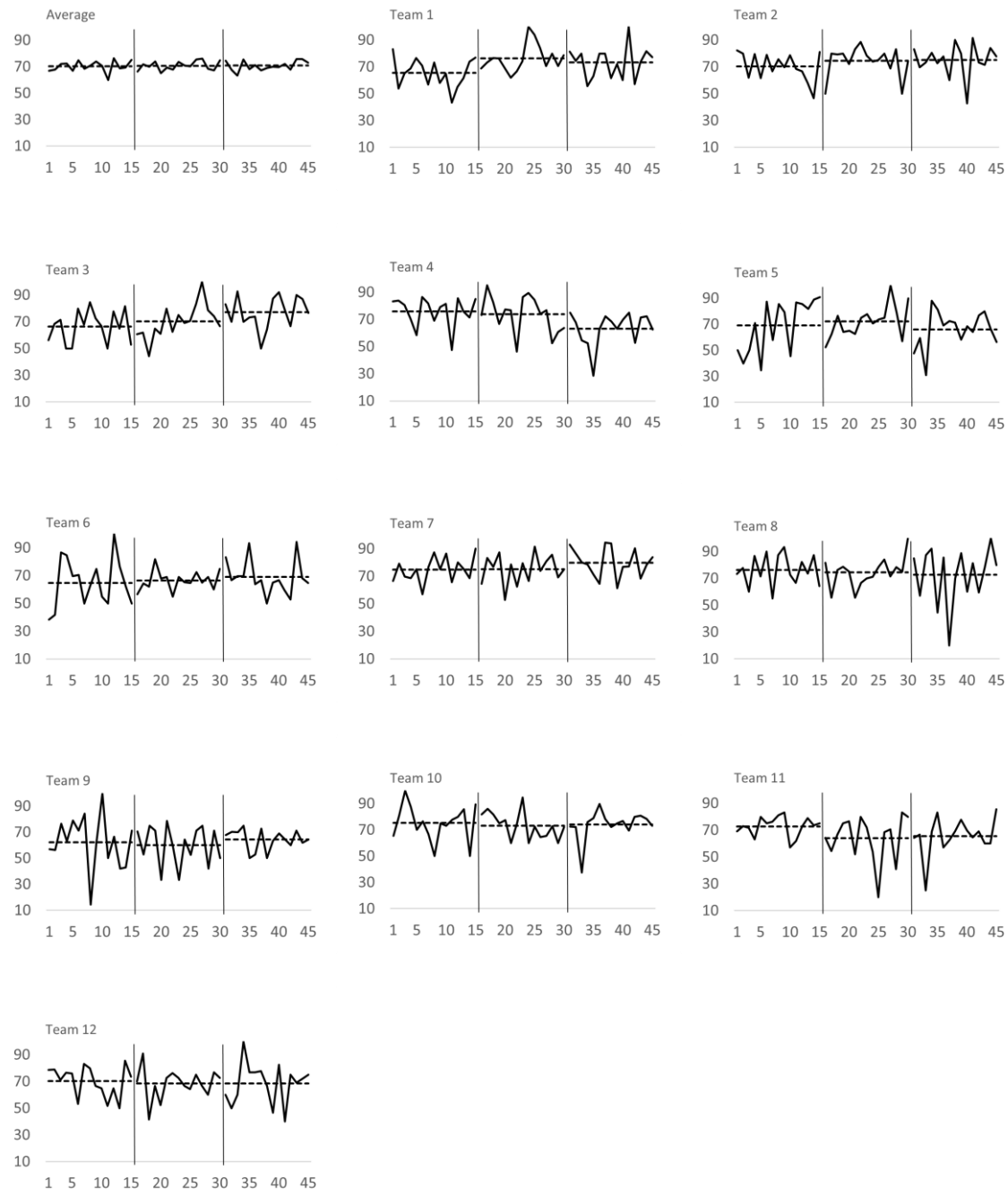
Team Findings

While group findings allow us to compare the data of participants, they may not give us the full picture of what is going on at the individual level. Figure 3 shows the trajectories for each team on their free throw percentage over the last three seasons. Since each team had played at least 15 games in each season, the graph portrays data from the first 15 games of each season. The middle section of each graph represents the second season without crowds. The dashed lines represent the mean free throw percentage of the games in each season. While the graph representing the average shows a relatively level trend with little variation, we can see in the other graphs that each team had their own unique trends. From the first season to the second season, half the teams mean free throw percentage increased and the other half decreased. From the second season to the third season, eight teams increased in mean free throw performance while four teams decreased. The only significant change in performance of these comparisons was an increase in free throw performance for Team 1 from the first season (M = 65.5, SD = 10) to the second season (M = 76.3, 10.2), $t(14) = 2.45$, $p = .03$, 95% C.I [1.3, 20.4], $d = .63$. In our

hypothesis, we predict that the middle season without crowds would show the least successful free throw percentage. This only happened for four of the teams, while two showed the opposite.

Figure 3

Teams Free Throw Percentage

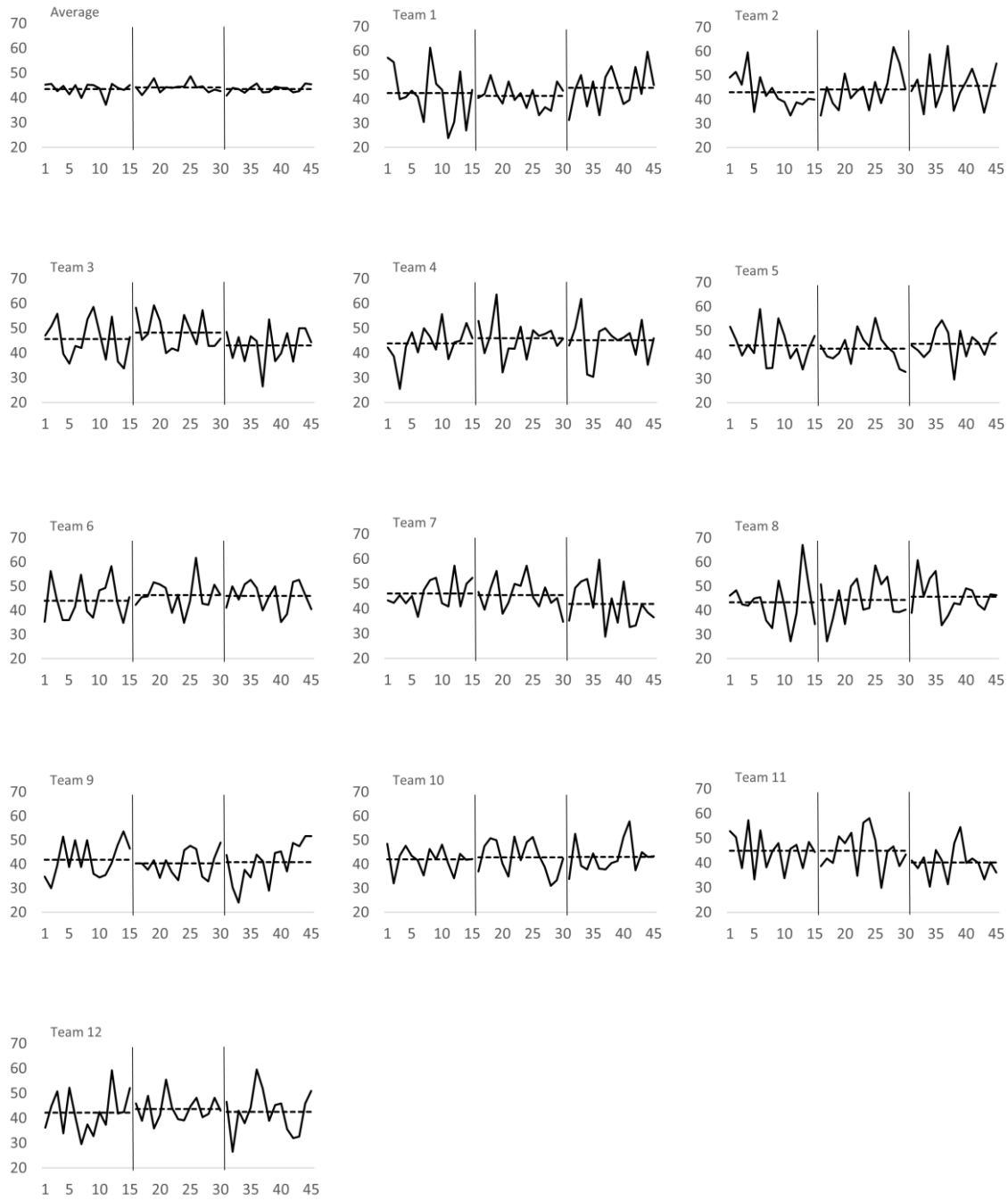


Note. The y-axis represents free throw (FT)%. The x-axis represents the games. Games 1-15 = 2019-2020 season. Games 16-30 = 2020-2021. Games 31-45 = the 2021-2022.

Figure 4 presents the trajectories for each individual team on their field goal percentage over the last three seasons. In contrast to the group data for field goal percentage, these data use all gameplay in this figure instead of separating out conference gameplay. From the first season to the second season, seven teams showed an increased mean field goal percentage, one showed no change, and four showed a decrease. From the second season to the third season, half of the teams showed an increased mean field goal percentage, and half of the teams showed a decrease. The only significant change in performance of these comparisons was a decrease in field goal performance for Team 11 from the second season (M = 44.9, SD = 7.9) to the third season (M = 40.3, SD = 6.2), $t(14) = -2.36$, $p = .03$, 95% C.I [-8.9, -0.4], $d = .61$. Similar to the free throw analysis, observations from each team show greater variability and different trends than the average graph portrays. Only four players showed a trend that supported our hypothesis that the middle season without crowds would show the most successful field goal percentage while two showed the opposite.

Figure 4

Teams Field Goal Percentage



Note. The y-axis represents field goal (FG)%. The x-axis represents the games. Games 1-15 = 2019-2020 season. Games 16-30 = 2020-2021. Games 31-45 = the 2021-2022.

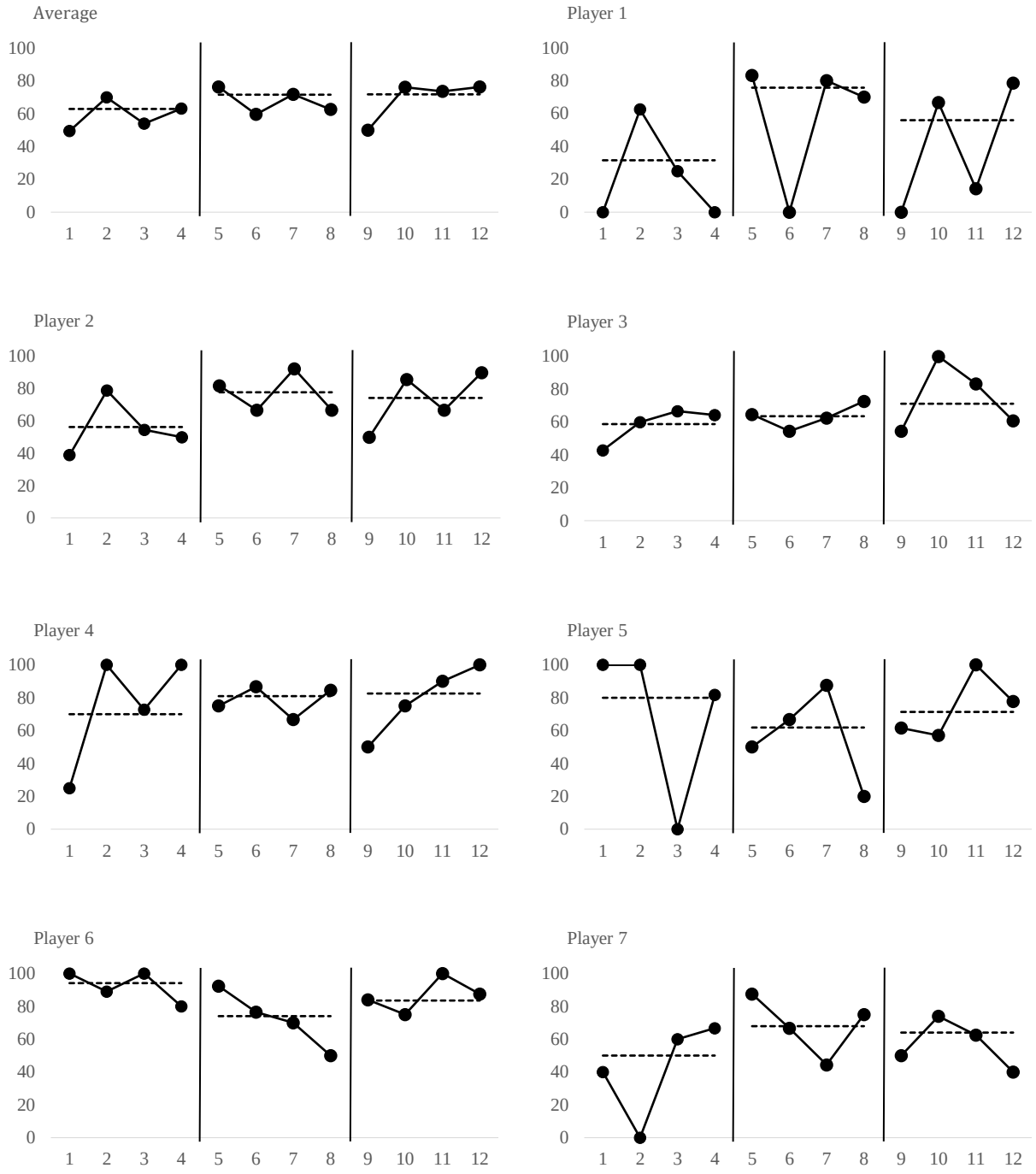
Individual Findings

Instead of graphing the individuals on a game-by-game basis, we graphed field goals in blocks of three games only in conference play, and free throws in blocks of four games in all regular season games. All the players in the study participated in four blocks of field goals (12 games) and four blocks of free throws (16 games) for each season. However, four of the players did not have any attempts in at least one of these blocks and were excluded from the exploratory analysis.

Figure 5 shows the trajectories for each player on their free throw performance for the first four blocks of each season. The dashed lines represent the total free throw percentage for the number of games (16) used in each season. The dashed lines used in the graph showing average results is the mean of the total free throw percentage from each player's 16-game analysis for each season. Once again, we see a different picture for each athlete. This analysis is limited by the comparatively low number of free throw attempts a player may shoot in a block compared to field goals. For example, free throw percentages in these graphs range from 0 to 100% as a player may only shoot two free throws in one block and 20 in another. Of the seven players included in this analysis, five improved their total throw percentage for these games from the 2019-2020 season with crowds to the 2020-2021 season without crowds, while two worsened. Furthermore, from the 2020-2021 season to the 2021-2022 season with crowds, four improved and three worsened again. Only two players showed a trend that supported our hypothesis that the middle season would be the season with the least successful free throw percentage while three showed the opposite. Observations from the graphs portray this variation among individuals. These differences among players weakens any inferences from the group data.

Figure 5

Individuals Free Throw Percentage

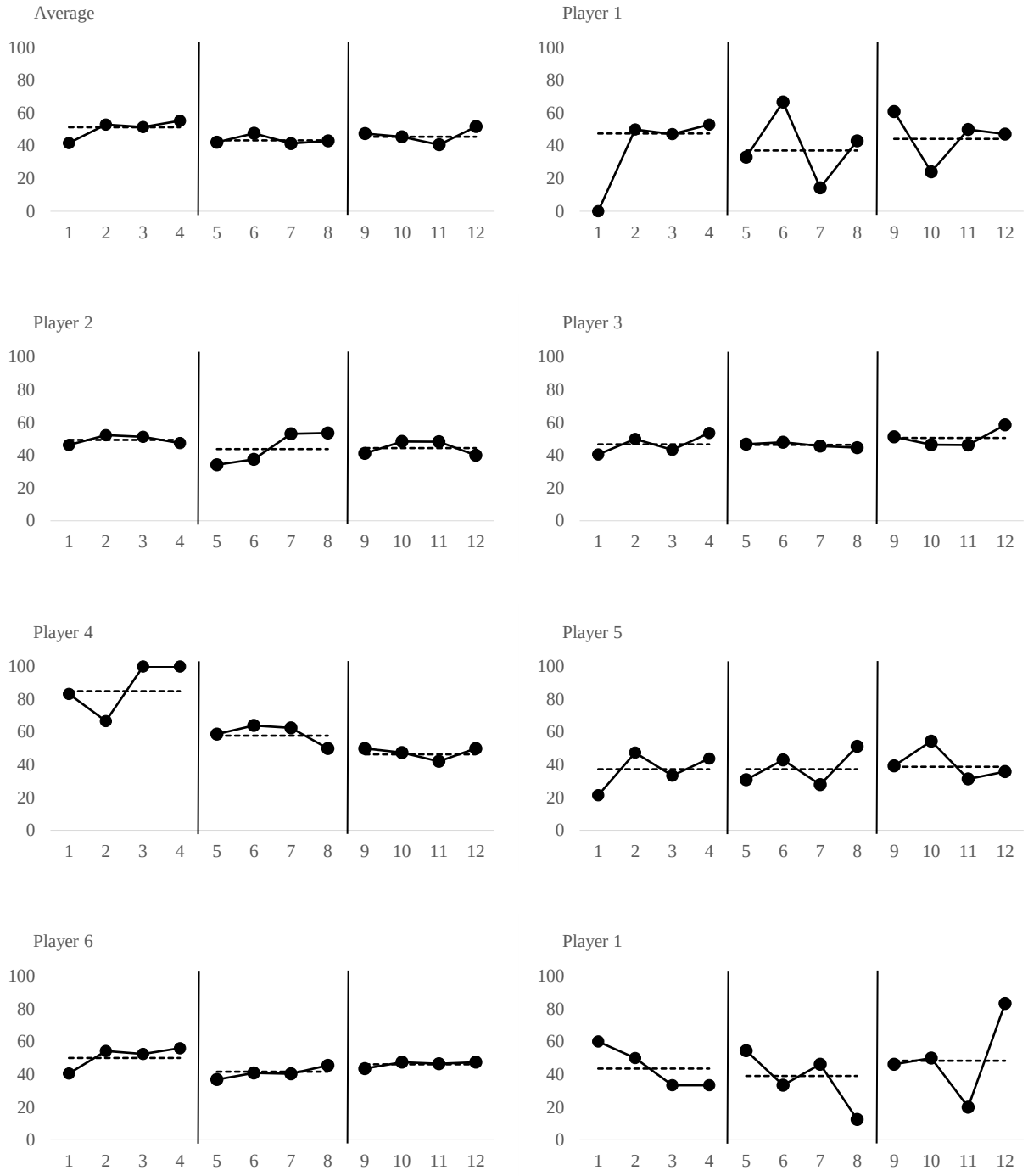


Note. The y-axis represents free throw (FT)%. Each point on the x-axis represents a four-game stretch within the 2019-2020 (1-4), 2020-2021 (5-8), and 2021-2022 (9-12) seasons.

Figure 6 presents the trajectories for player field goal performance. Even though we do see a drop in the average from the first season to the next two seasons, the large drop in player 4's graph is likely contributing to this trend in the group average. However, in the seven players included in the analysis, six of them did see a decrease in total field goal percentage for these games from the first season to the second season. Furthermore, six of the players improved from season two to three. In our hypothesis, we predict that the middle season without crowds would show the most successful field goal percentage. None of these players performed best in this complex task in the middle season. On the contrary, for five of these players the middle season was the worst showing in field goal percentage.

Figure 6

Individuals Field Goal Percentage



Note. The y-axis represents field goal (FG)%. Each point on the x-axis represents a three-game stretch within the 2019-2020 (1-4), 2020-2021 (5-8), and 2021-2022 (9-12) seasons.

Discussion

The purpose of this study was to contribute to research on social facilitation theory by analyzing performance of simple and complex tasks on home and away games in basketball competition over the years 2019-2022 with and without crowds. We hypothesized that in games with crowds, simple tasks (free throws) would be more successful and complex tasks (field goals) would be less successful compared to games without crowds. We further hypothesized that home performances would be better than away performances in seasons with crowds, but there would be no difference without crowds.

Our results on social facilitation effects of task performance showed mainly non-significant trends, and the results for the teams and individuals were inconsistent with each other. The only statistically significant change in performance was an improved individual free throw performance from the first season to the second season in away games. While individual free throw percentage in home games improved between these seasons, it was non-significant. This suggests that social facilitation effects for simple tasks may be stronger in away settings than home settings. However, because of our non-significant and inconsistent findings, our null results are not able to support our hypothesis or suggest other effects. In Bond and Titus' meta-analysis of 241 studies and 24,000 participants, they found that the presence of others impairs complex performance accuracy and slightly facilitates simple performance accuracy (1983). Our experiment utilizing real-life settings does not support these findings, but our small and non-significant trends do align with their conclusion that the presence of others has small effects and accounts for only 0.3 to 3% of the variance in any typical experiment. Furthermore, Bond and Titus concluded that facilitation is vulnerable to the "file drawer problem" of researchers not

reporting null results. Therefore, this study adds to the possible file drawer of inconclusive results in this area.

Our exploratory analysis further showed that while there may have been trends in observing results of the teams and individuals as groups, inspecting them as each team and player revealed many individual differences. This may further reject our expectations that social facilitation effects would occur, or it suggests that social facilitation effects vary among players based on different variables. One thing to keep in mind is that while we chose to classify free throws as a simple task and field goals as a complex task, the complexity of these tasks will vary based on the experience and skill set of each player. For example, a player may have never perfected the right response to free throws, and this still may be a complex task, while the same player finds it easier to stand near the rim and perform practiced basketball moves to make shots during gameplay. Also, individual differences in social facilitation may be due to personality differences that influence cognitive appraisals (Uziel, 2006), and different arousal responses to crowds in the performers (Blascovich et al., 1999). Future research should focus on individual differences such as gender (Heinrich et al., 2021), personality, arousal levels, performance anxiety, cognitive processes, experience, and individual's skill level. Exploring these variables will help explain findings in the light of social facilitation theories such as drive theory, evaluation apprehension theory, and cognitive theories.

In our analysis of home and away performances in each season for each task, we only found one significant difference. This was in free throw performances for individuals in the first season. This rejects our hypothesis that crowds would affect homefield advantage, and further rejects that significant homefield advantage occurs at all for task performance, irrespective of crowd presence. These results support an understanding that home field advantage is not due to

differences in individual task performance (Moskowitz & Wertheim, 2011). Future research should continue to analyze other causes of home field advantage such as the impact of spectators on referee decisions (Bryson et al., 2020; Dohmen & Sauermann, 2016).

While we do see a disappearance in significant home field advantage in individual free throw performance from the first season with crowds to the second season without crowds, the home field advantage does not return in the third season. This follows a pattern in both task complexity and home and away differences that in the third season, when crowds are presented back into arenas, performance differences do not follow trends similar to the first season. Observations of the task performance plots show that many trends from the first two seasons are stronger than the trends from seasons two to three. This may be because while crowds did return in the third season, the COVID-19 pandemic was still prevalent, and most arenas observed physical distancing rules. Furthermore, crowds at games were most likely less in size and density which could have tampered potential home field advantages and social facilitation effects. Also, by this time the individuals had two years of experience in NCAA basketball and their skill level on these tasks may have changed as well as their ability to handle crowds. Therefore, while the first and third seasons are treated as similar sessions in the data, they do have important differences that may cause different relationships to the middle season without crowds.

This study analyzes free throws as a simple task and field goals as a complex task. While both performance measures can be separated by task complexity, they also occur within different crowd conditions. When a player stands on the free throw line and is preparing to shoot, the other players along with the crowd watch in anticipation of either failure or success. This predicament may produce a heightened evaluative presence which can further heighten arousal levels (Baumeister, 1982). Fine motor skills like shooting free throws are susceptible to choking,

a phenomenon that occurs when self-presentational concerns and accompanying anxiety produce performance impairment (Leary, 1992). Field goals are performed in a crowd condition that is arguably less evaluative. It takes more basketball knowledge to assess the array of shots taken during gameplay in different situations than the performance of a more common task without defenders. Furthermore, it is easier for the crowd to focus on and assess a free throw than the complex nature of field goals. While laboratory studies of simple and complex tasks can control confounding crowd conditions such as these, it is a part of this natural experiment that may be affecting social facilitation effects. Future research should continue to focus not only on the absence and appearance of crowds, but the evaluative characteristics of crowds.

The scope of the findings in this research is limited by a small sample size of elite college athletes. Analyzing teams allows for a larger set of data. In each NCAA basketball game, team field goal attempts and free throw attempts will be much greater than any individual player. However, analyzing teams does not provide as reliable data because the make-up of a team changes from year to year, further confounding any variables that may cause differences in team performance. Analyzing players provides a more reliable but small data set. Furthermore, selection processes favored players that scored the most points which is biased towards higher skilled players. This may contribute to the difference in team and individual results, as teams are made up of a more dispersed set of skill levels. This study seeks to control skill level by assessing similar players and teams in one conference in NCAA D1 men's basketball. Future research should assess not only college athletes but should focus on all skill levels from youth sports to professional leagues. Furthermore, samples do not need to be athlete populations, but can be any population that performs tasks in front of spectators. Research that utilizes larger sample sizes will allow for higher statistical power and more complex analysis. For example, if a

study like this had a larger sample size, researchers could use group-based trajectory modeling to pinpoint distinct trajectories among the groups.

The findings in our research imply a difference between traditional experiments in this area and natural experiments in the results of social facilitation effects. As managers, coaches, and athletes combine effort to promote optimal performance, more natural experiments such as this will help them build a greater knowledge base. Experts in the sports industry have already started to use a data analytics approach to making business and coaching decisions (Singh, 2020; Bharathan et al., 2015). The use of data analytics in sports to help determine psychological mindsets of athletes in game situations (Hopfensitz & Mantilla, 2019) can be helpful in not only expanding knowledge in the field of psychology but can aide leaders in the sports industry in figuring out certain variables that need to be attended to in order to promote performance. For example, if a team uses a similar data analytics approach and finds that the absence of crowds significantly improved performance in their players, it may be wise to assess which individuals need help performing in front of crowds and employ practice tactics to promote optimal performance no matter who is in the stands. Furthermore, it can affect decisions such as play calling and lineups in games with varying levels of audiences. Therefore, the use of data analytics in sports to assess performance in front of crowds and applied research that focuses on how athletes can mitigate these performance risks can help performers and teams play at their best in any situation.

References

Agnew, G. A., & Carron, A. V. (1994). Crowd effects and the home advantage. *International Journal of Sport Psychology*, *25*(1), 53-62. http://ezproxy.emich.edu/login?url=https://www-proquest-com.ezproxy.emich.edu/scholarly-journals/crowd-effects-home-advantage/docview/618603689/se-2?accountid=10650

Aiello, J. R., & Douthitt, E. A. (2001). Social facilitation from Triplett to electronic performance monitoring. *Group Dynamics: Theory, Research, and Practice*, *5*(3), 163–180. http://dx.doi.org.ezproxy.emich.edu/10.1037/1089-2699.5.3.163

Allport, F. H. (1920). The influence of the group upon association and thought. *Journal of Experimental Psychology*, *3*(3), 159–182. http://dx.doi.org.ezproxy.emich.edu/10.1037/h0067891

Aufenanger, S. J. (2005). *Relationships between mental skills and competitive anxiety interpretation in open skill and close skill athletes.* [Master's Thesis, Miami University]. https://etd.ohiolink.edu/apexprod/rws_etd/send_file/send?accession=miami1117130981&disposition=inline

Baron, R. S. (1986). Distraction–conflict theory. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (pp. 1–39). Orlando, FL: Academic Press

Baumeister, R. F. (1982). A self-presentational view of social phenomena. *Psychological Bulletin*, *91*, 3-26.

Bharathan, S., Sundarraj, R. P., Abhijeet, S., & Ramakrishnan, S. (2015). A self-adapting intelligent optimized analytical model for team selection using player performance utility in cricket. In *9th MIT Sloan Sports Analytics Conference, MIT, Boston* (pp. 1-11).

Blascovich, J., Mendes, W. B., Hunter, S. B., & Salomon, K. (1999). Social "facilitation" as challenge and threat. *Journal of Personality and Social Psychology, 77*(1), 68–77. https://doi.org/10.1037/0022-3514.77.1.68

Blomqvist Mickelsson, T., & Shaw, V. (2020). Performance increments without audience: Paired data from mixed martial arts fighters during COVID-19. *El Rendimiento Mejora En Ausencia de Espectadores: Datos Pareados de Luchadores de Artes Marciales Mixtas Durante La COVID-19., 15*(2), 50–58. https://doi.org/10.18002/rama.v15i2.6294

Böheim, R., Grübl, D., & Lackner, M. (2019). Choking under pressure – Evidence of the causal effect of audience size on performance. *Journal of Economic Behavior & Organization, 168*, 76–93. https://doi.org/10.1016/j.jebo.2019.10.001

Bond, C. F., & Titus, L. J. (1983). Social facilitation: A meta-analysis of 241 studies. *Psychological Bulletin, 94*(2), 265–292. https://doi.org/10.1037/0033-2909.94.2.265

Bryson, A., Dolton, P., Reade, J. J., Schreyer, D., & Singleton, C. (2020). Experimental effects of an absent crowd on performances and refereeing decisions during Covid-19. *SSRN Electronic Journal.* https://doi.org/10.2139/ssrn.3668183

Carver, C. S., & Scheier, M. F. (1981). The self-attention-induced feedback loop and social facilitation. *Journal of Experimental Social Psychology, 17*, 545–568.

Cottrell, N. B. (1972). Social facilitation. In C. G. McClintock (Ed.), *Experimental social psychology* (pp. 185-236). New York: Holt.

Crewther, B. T., Potts, N., Kilduff, L. P., Drawer, S., & Cook, C. J. (2020). Performance indicators during international rugby union matches are influenced by a combination of physiological and contextual variables. *Journal of Science and Medicine in Sport, 23*(4), 396–402. https://doi.org/10.1016/j.jsams.2019.10.011

Dawson, P., & Dobson, S. (2010). The influence of social pressure and nationality on individual decisions: Evidence from the behaviour of referees. *Journal of Economic Psychology*, *31*(2), 181–191. https://doi.org/10.1016/j.joep.2009.06.001

Di Fronso, S., Costa, S., Montesano, C., Di Gruttola, F., Ciofi, E. G., Morgilli, L., Robazza, C., & Bertollo, M. (2020). The effects of covid-19 pandemic on perceived stress and psychobiosocial states in Italian athletes. *International Journal of Sport and Exercise Psychology*, http://dx.doi.org.ezproxy.emich.edu/10.1080/1612197X.2020.1802612

Dohmen, T. J. (2008). Do professionals choke under pressure? *Journal of Economic Behavior & Organization*, *65*(3), 636–653. https://doi.org/10.1016/j.jebo.2005.12.004

Dohmen, T., & Sauermann, J. (2016). Referee Bias. *Journal of Economic Surveys*, *30*(4), 679–695. https://doi.org/10.1111/joes.12106

Epting, L. K., Riggs, K. N., Knowles, J. D., & Hanky, J. J. (2011). Cheers vs. Jeers: Effects of audience feedback on individual athletic performance. *North American Journal of Psychology*, *13*(2), 299–312.

ESPN. (2020, October 8). *Everything that happened in the NBA bubble*. https://www.espn.com/nba/story/_/id/30055011/everything-happened-nba-bubble

ESPN. (2021, March 11). *Visual timeline of the day that changed everything: March 11*. https://www.espn.com/espn/story/_/id/30546338/visual-line-day-changed-everything-march-11

Feltz, D., & Kontos, A. (2002). The nature of sport psychology. In T.S. Horn (Ed.), *Advances in sport psychology* (p. 3-19). Human Kinetics.

Fischer, K., & Haucap, J. (2020). Does crowd support drive the home advantage in professional soccer? evidence from German ghost games during the Covid-19 pandemic (SSRN Scholarly Paper ID 3697062). *Social Science Research Network.* https://papers.ssrn.com/abstract=3697062

Fischman, M.G., & Oxendine, J.B., (1998). Motor skill learning for effective coaching and performance. In J. M. Williams (Ed.), *Applied sport psychology: Personal growth to peak performance* (3rd ed.) (pp.13-27). Mountain View, CA: Mayfield.

Gaudreau, P., & Blondin, J. (2004). Differential associations of dispositional optimism and pessimism with coping, goal attainment, and emotional adjustment during sport competition. *International Journal of Stress Management, 11*, 245–269. https://psycnet.apa.org/doi/10.1037/1072-5245.11.3.245

Geen, R. G. (1989). Alternative conceptions of social facilitation. In P. B. Paulus (Ed.), *Psychology of group influence, 2nd ed* (pp. 15–51). Lawrence Erlbaum Associates, Inc.

Geen, R. G., & Gange, J. J. (1977). Drive theory of social facilitation: Twelve years of theory and research. *Psychological Bulletin, 84*(6), 1267–1288. http://dx.doi.org.ezproxy.emich.edu/10.1037/0033-2909.84.6.1267

Geukes, K., Mesagno, C., Hanrahan, S. J., & Kellmann, M. (2013). Activation of self-focus and self-presentation traits under private, mixed, and public pressure. *Journal of Sport & Exercise Psychology, 35*(1), 50–59. https://doi.org/10.1123/jsep.35.1.50

Hasegawa, Y., Koyama, S., & Inomata, K. (2013). Perceived distance during golf putting. *Human Movement Science, 32*(6), 1226–1238. https://doi.org/10.1016/j.humov.2013.02.003

Hopfensitz, A., & Mantilla, C. (2019). Emotional expressions by sports teams: An analysis of world cup soccer player portraits. *Journal of Economic Psychology, 75*, 17. http://dx.doi.org/10.1016/j.joep.2018.04.008

Huguet, P., Galvaing, M. P., Monteil, J. M., & Dumas, F. (1999). Social presence effects in the Stroop task: Further evidence for an attentional view of social facilitation. *Journal of Social and Personality Psychology, 77*, 1011–1025.

Jamieson, J. P. (2010). The home field advantage in athletics: A meta-analysis: home-field advantage. *Journal of Applied Social Psychology, 40*(7), 1819–1848. https://doi.org/10.1111/j.1559-1816.2010.00641.x

Jiménez Sánchez, Á., & Lavín, J. M. (2021). Home advantage in European soccer without crowd. *Soccer & Society, 22*(1–2), 152–165. https://doi.org/10.1080/14660970.2020.1830067

Kay, E. M., & Martens, A. (2015). Social facilitation in National Basketball Association teams [Master's Thesis, University of Canterbury]. University of Canterbury. Psychology. http://dx.doi.org/10.26021/6118

Kotzer, R. (2007). The social facilitation effect in basketball: Shooting free throws. *The Huron University College Journal of Learning and Motivation, 45*(1). https://ir.lib.uwo.ca/hucjlm/vol45/iss1/8

Leary, M. R. (1992). Self-Presentational Processes in Exercise and Sport, *Journal of Sport and Exercise Psychology, 14*(4), 339-351. Retrieved Apr 18, 2022, from https://journals.humankinetics.com/view/journals/jsep/14/4/article-p339.xml

Martens, R. (1969). U. Illinois, Children's Research Center. *Journal of Personality and Social Psychology, 12*(3), 252–260. http://dx.doi.org.ezproxy.emich.edu/10.1037/h0027710

McHill, A. W., & Chinoy, E. D. (2020). Utilizing the National Basketball Association's COVID-19 restart "bubble" to uncover the impact of travel and circadian disruption on athletic performance. *Scientific Reports, 10*(1), 21827. https://doi.org/10.1038/s41598-020-78901-2

Mehrsafar, A. H., Moghadam Zadeh, A., Jaenes Sánchez, J. C., & Gazerani, P. (2021). Competitive anxiety or coronavirus anxiety? the psychophysiological responses of professional football players after returning to competition during the COVID-19 pandemic. *Psychoneuroendocrinology, 129*, 8. http://dx.doi.org/10.1016/j.psyneuen.2021.105269

Mesagno, C., Harvey, J. T., & Janelle, C. M. (2011). Self-presentation origins of choking: Evidence from separate pressure manipulations. *Journal of Sport & Exercise Psychology, 33*(3), 441–459. https://doi.org/10.1123/jsep.33.3.441

Meumann, E. (1904). Haus- und Schularbeit [Homework and schoolwork]. Leipzig: Barth.

Moore, J. C., & Brylinsky, J. A. (1993). Spectator effect on team performance in college basketball. *Journal of Sport Behavior, 16*(2), 77–84.

Mon-López, D., de la Rubia Riaza, A., Hontoria Galán, M., & Refoyo Roman, I. (2020). The Impact of Covid-19 and the Effect of Psychological Factors on Training Conditions of Handball Players. *International Journal of Environmental Research and Public Health, 17*(18), 6471. https://doi.org/10.3390/ijerph17186471

Moskowitz, T. J., & Wertheim, L. J. (2011). *Scorecasting: The hidden influences behind how sports are played and games are won.* New York: Three Rivers Press.

NCAA. (2021). *Attendance records through 2020-2021*. NCAA Men's Basketball Attendance - NCAA.org

Nevill, A. M., & Holder, R. L. (1999). Home advantage in sport. *Sports Medicine, 28*(4), 221–236. https://doi.org/10.2165/00007256-199928040-00001

Nitin, S. (2020). Sport analytics; a review. *The International Technology Management Review, 9*(1), 64–69. https://doi.org/10.2991/itmr.k.200831.001

Ogawa, A., & Sekiya, H. (2016). Effects of practice and psychological pressure on interpersonal coordination failures. *Perceptual and Motor Skills, 122*(3), 956–970. https://doi.org/10.1177/0031512516647692

Russell, G. W. (1983). Crowd size and density in relation to athletic aggression and performance. *Social Behavior and Personality: An International Journal, 11*(1), 9–15. http://dx.doi.org.ezproxy.emich.edu/10.2224/sbp.1983.11.1.9

Sanders, G. S., Baron, R. S., & Moore, D. L. (1978). Distraction and social comparison as mediators of social facilitation effects. *Journal of Experimental Social Psychology, 14*, 291–303

Schwartz, B., & Barsky, S. F. (1977). The home advantage. *Social Forces, 55*(3), 641–661. https://doi.org/10.2307/2577461

Smith, R. E., & Christensen, D. S. (1995). Psychological skills as predictors of performance and survival in professional baseball. *Journal of Sport and Exercise Psychology, 17*(4), 399–415. https://doi.org/10.1123/jsep.17.4.399

Strube, M. J. (2005). What Did Triplett Really Find? A Contemporary Analysis of the First Experiment in Social Psychology. *The American Journal of Psychology, 118*(2), 271–286. http://www.jstor.org/stable/30039059

Tanaka, Y., & Sekiya, H. (2010). The influence of audience and monetary reward on the putting kinematics of expert and novice golfers. *Research Quarterly for Exercise & Sport, 81*(4), 416–424. https://doi.org/10.5641/027013610X13088600029139

Triplett, N. (1898). The dynamogenic factors in pacemaking and competition. *The American Journal of Psychology, 9*(4), 507–533. https://doi.org/10.2307/1412188

Uziel, L. (2007). Individual differences in the social facilitation effect: A review and meta-analysis. *Journal of Research in Personality, 41*(3), 579-601. http://dx.doi.org/10.1016/j.jrp.2006.06.008

Wann, D. L., & Hackathorn, J. (2019). Audience effects in sport: The reciprocal flow of influence between athletes and spectators. In M. H. Anshel, T. A. Petrie, & J. A. Steinfeldt (Eds.), *APA handbook of sport and exercise psychology, vol. 1: Sport psychology*, (pp. 469–488). American Psychological Association. https://doi.org/10.1037/0000123-024

Woodman, T., Albinson, J.G., & Hardy, L. (1997). An Investigation of the Zones of Optimal Functioning Hypothesis Within a Multidimensional Framework. *Journal of Sport & Exercise Psychology, 19*, 131-141.

Wright, J. L. (2015). *The relationship between live crowds, competitive anxiety, and performance for high school basketball players* (Order No. 3682185) [Doctoral dissertation, Capella University]. ProQuest Dissertations Publishing.

Zajonc, R. B. (1965). Social facilitation. *Science, 149*(Whole No. 3681), 269–274. https://doi.org/10.1126/science.149.3681.269

Zajonc, R. B. (1980). Compresence. In P. B. Paulus (Ed.), *Psychology of group influence* (pp. 35-60). Hillsdale, NJ: Erlbaum