Stoker, M, Maynard, I, Butt, J, Hays, K and Hughes, P

The Effect Of Manipulating Individual Consequences And Training Demands On Experiences Of Pressure With Elite Disability Shooters

The Effect of Manipulating Individual Consequences and Training Demands on Experiences of Pressure with Elite Disability Shooters

Mike Stoker[1], Ian Maynard[2], Joanne Butt[3], Kate Hays[1] & Paul Hughes[1], 2019.

English Institute of Sport[1]
University of Essex[2]
Sheffield Hallam University[3]

Abstract

In previous research, multiple demands and consequences were manipulated simultaneously to examine methods for pressure training (Stoker et al., 2017). Building on literature, in this study a single demand or consequence stressor was manipulated in isolation. Specifically, in a matched, within-subject design, six international shooters (M_{age} = 28.67) performed a shooting task whilst exposed to a single demand (task, performer, environmental) or consequence (reward, forfeit, judgment) stressor. Perceived pressure, anxiety (intensity and direction), and performance was measured. Compared to baseline, manipulating demands did not affect pressure or anxiety. In contrast, pressure and cognitive anxiety significantly increased when judgment or forfeit consequence stressors were introduced. Thus, the findings lack support for manipulating demands but strongly support introducing consequences when pressure training. Compared to baseline, the judgment stressor also created debilitative anxiety. Hence, in terms of introducing a single stressor, judgment appeared most impactful and may be most effective for certain athlete populations.

Key words: stressor, demands, pressure, consequences, choking, anxiety

The Effect of Manipulating Individual Consequences and Training Demands on Experiences of Pressure with Elite Disability Shooters

Performance pressure, defined as “any factor or combination of factors that increases the importance of performing well on a particular occasion” (Baumeister, 1984; p. 610), has been shown to cause individuals to perform below their actual ability (DeCaro, Thomas, Albert, & Beilock, 2011). Referred to as choking (Baumeister, 1984), a body of literature has been dedicated towards exploring interventions for preventing this type of underperformance (Hill, Hanton, Matthews, & Fleming, 2010). Some previous approaches for reducing choking have been identified and include pre-performance routines (Mesagno, Marchant, & Morris, 2008), quiet eye training and analogy learning (Vine, Moore, Cooke, Ring, & Wilson, 2013), and implicit learning (Hill, Hanton, Matthews, & Fleming, 2010). Additionally, stressor-exposure approaches have recently grown in popularity and are proving to be an effective means for preventing choking worthy of continued investigation (e.g., Lawrence et al., 2014; Oudejans & Pijpers, 2009; Stoker, Lindsay, Butt, Bawden, & Maynard, 2016).

Pressure training (PT) can be defined as a stressor-exposure program that specifically focusses on reducing choking and developing performance under pressure by strategically exposing individuals to pressurized environments (cf. Oudejans & Pijpers, 2009; Stoker et al., 2017). Previous research has provided an indication that pressure training can be used to successfully prevent choking and enhance performance. For example, Bell, Hardy, and Beattie (2013) undertook research that exposed elite youth cricketers to a number of consequence stressors during training. Results showed that these players made significant improvements in objective and subjective mental toughness scores, indicating an enhanced ability to perform under pressure. In wider research, stressor-exposure methods have also been shown to be impactful across a range of sports, such as cricket (Bell et al., 2013), soccer

(Reeves, Tenenbaum, & Lidor, 2007), and field hockey studies (Mesagno, Harvey, & Janelle, 2011). Yet, despite growing interest and successful PT interventions (e.g., Bell et al., 2013; Lawrence et al., 2014), little research has investigated how to systematically create pressurized training environments in sport.

Addressing this issue, Stoker and colleagues (2016) investigated elite coaches' methods for pressure training. A framework was developed which indicated that elite coaches managed the demands of training (via the manipulation of task, performer, and environmental stressors) to control the difficulty of the training session. Task stressors involved manipulating the rules of play, performer stressors involved manipulating the physical and psychological functioning of an athlete and environmental stressors involved manipulating external surroundings. This framework also documented that coaches introduced consequences into training alongside the manipulated demands. These consequences could be judgment stressors, such as being evaluated by peers, rewards, such as selection, or forfeits, such as missing a training session. In managing these two facets of training (i.e., training demands and consequences), coaches perceived themselves to create performance enhancing PT environments.

In a follow-up study, Stoker and colleagues (2017) tested the effectiveness of this PT framework by investigating the impact of manipulating these two categories of stressors (i.e., demands and consequences) on athletes' experiences of pressure, heart-rate, anxiety intensity and direction. Specifically, elite netballers performed a shoulder pass drill while exposed to demand stressors (e.g., time constraint), consequence stressors (e.g., monetary reward), or a combination of demand and consequence stressors. Results revealed that manipulating consequences, or a combination of demands and consequences, significantly increased perceived pressure, heart-rate, and cognitive anxiety, whilst manipulating demand stressors alone did not. However, while manipulating demand stressors were important for impacting performance, manipulating these stressors alone was found to have no impact on pressure. Thus, the results revealed mixed support for the effect of training demands on pressure and strong support for the effects of consequences on pressure and demands on performance.

In summary of the research highlighted previously, Stoker and colleagues developed (2016) and tested (2017) a framework for systematically creating pressurized training environments. Their findings indicated strong support for the role of consequences in generating pressure and mixed support for the influence of training demands. In light of these findings and wider research that has also provided consistent evidence for consequences and mixed support for demands (e.g., Bell et al., 2013; Mesagno et al., 2011; Weinberg, Butt, & Culp, 2011), there appears to be a need to provide further clarity regarding the distinct roles of these two stressors when creating pressurized training environments. Indeed, Stoker and colleagues suggested that in further investigating this area it could be important to examine the specific effects of manipulating each individual demand (i.e., task, performer or environmental) or consequence (i.e., reward, forfeit or judgment) stressor on performance. Such research could refine knowledge regarding the precise effects of training demands and consequences. Additionally, such an exploration could provide additional insight regarding which specific demand or consequence stressors coaches should manipulate in order to maximize their time and resources. With these considerations in mind, in the present study a PT framework that was generated by Stoker and colleagues (2016) was used to examine the specific effect of each individual demand (i.e., task, performer, or environmental) and consequence (i.e., reward, forfeit, or judgment) stressor on experiences of pressure. It was hypothesized that each individual demand and consequence stressor would increase experiences of pressure and that increasing each demand stressors would negatively affect performance.

Methods

Participants

After institutional ethics approval was obtained, the sample was identified purposively in accordance with the previous research upon which the current study was based (see Stoker et al., 2017). These requirements included recruiting participants: (i) of elite/international standard; (ii) that belonged to a sporting program that wanted to PT; (iii) that were not in a competition phase; (iv) that met regularly for training; (v) and that used a venue with private training facilities. In line with these requirements, six elite athletes from the Great Britain disability shooting team were invited to participate in the study. The participating sport and athletes provided consent for the present research to be publicized without anonymity. Initial contact was made with the Performance Director of British Disability Shooting via the team Sport Psychologist. The research study was approved due to the sports' desire to develop the teams' knowledge and experience of PT. Athletes volunteered to participate following permission from the Performance Director and informed consent was then obtained from each athlete. The participants were aged between 20 and 41 years (M_{age} 28.67; SD = 8.82) and had performed at the elite level for an average of 9.83 years (SD = 6.34). At the time of the study, the team was beginning the initial stage of preparation for a World Cup tournament. It was expected that the participants' relatively high level of international experience might mean that they perceive pressure as facilitative, thus, pressure might positively impact performance (cf. Oudejans & Pijpers, 2009). For this same reason, it was anticipated that it might be challenging to identify stressors that are meaningful enough to generate high levels of pressure in their elite sample.

Design

The coaching framework developed by Stoker and colleagues (2016) was adopted to examine the effects of individually manipulating a task, performer, environmental, forfeit, reward or judgment stressor on the athletes' experiences of pressure. A within subject design was used with 7 conditions: baseline, task, performer, environmental, forfeit, reward, and judgment conditions. Across all conditions, the participants performed a moderately easy shooting exercise to avoid both floor and ceiling effects once stressors were introduced. To ensure that the exercise was moderately easy for the specific participants, it was required that the athletes' head coach select the exercise. Specifically, in line with previous literature (e.g., Stoker et al., 2017), the researchers gave clear instructions for the head coach to design a shooting exercise that would be experienced by all the participants as "moderately easy". There were no manipulations to the training demands of the exercise or the consequences in the baseline conditions. One stressor was manipulated in isolation across all the experimental conditions (i.e., in the task condition, one task stressor was manipulated). In the three demand conditions (the task, performer, and environmental conditions), the manipulation of stressors were designed to make the training demands moderately difficult. In the three consequences conditions (the forfeit, reward, and judgment conditions), the manipulation of stressors were designed to increase the perception of meaningful performance-contingent outcomes.

Experimental design. The study was designed in collaboration with the National Governing Body of British Disability Shooting and conducted over a seven-month period. Regarding the identification and designing of consequences, meetings were held with the participants where they were asked to identify consequences that created pressure in training, competition, social, and professional situations (Stoker et al., 2017). The coaching framework generated by Stoker et al. (2016) was used to guide the discussions and this ensured questions identified specific reward, forfeit, and judgment stressors. Following these meetings, the final experimental reward, forfeits, and judgments stressors were agreed upon via meetings with the Coaches, Performance Director, and support staff. The demand stressors and shooting exercise were designed by the coaches, and utilized their extensive knowledge of specific exercises and their athletes' capabilities. Following the piloting of the stressors and conditions with athletes who were on the team but not participating in the study, none of the stressors were modified for the experiment. Participation in the conditions was randomized so that each participant experienced the conditions in a different sequence.

Shooting exercise. In each condition, participants performed an exercise that involved shooting a string of 10 shots, on a 10 meter range, within 10 minutes. Participants shot from either the standing, prone or kneeling position, depending on which category they competed in. Five participants were rifle shooters and one performed with a pistol. In conditions without consequences (i.e., the baseline, task, performer, and environmental condition), the participants were not given a performance score that they were required to achieve. In the consequence conditions (i.e., the forfeit, reward, and judgment condition), the consequences were performance-contingent so it was necessary to introduce a required score. This score was calculated by taking each athlete’s mean score obtained from their last three competitions. This method of score calculation ensured comparability across the different skill levels, disability classes, shooting positions and guns. At competition, athletes are required to shoot strings of 10 shots on a 10m range.

Conditions. In accordance with Stoker and colleagues’ (2016) framework, task, performer, and environmental variables were manipulated to shape stressors relating to the demands of training. In line with previous literature (Stoker et al., 2017), a time stressor was used in the task condition. Specifically, as designed by the coaches, participants were given only six minutes to take their 10 shots. Due to the range of athletes’ disabilities, and the differential effect that physical stressors may have on athletes’ functional capabilities, performer stressors were required to be cognitive in nature. For example, physical pre-fatigue was omitted as an option, as were physical apparatus, clothing, and equipment stressors. However, the coaches identified that cognitive pre-fatigue was a suitable performer stressor that was also ecologically valid. Following deliberation of several potential cognitive pre-fatigue stressors, the coaches selected the Stroop test (Stroop, 1935). This stressor was selected due to its ability to expose athletes to increased stress and mental fatigue (Provost & Woodward, 1991) that could be reflective of competition (cf. Knicker et al., 2011). Athletes were screened for dyslexia. Several environmental stressors were available for use. For example, the athletes occasionally competed abroad with heightened temperature and regularly competed in different venues with varied lighting conditions. Consequently, heat and light manipulations were considered. However, given that there are consistently indiscriminate auditory distractions at competition (cf. Driskell, Sclafani, & Driskell, 2014), and that previous research has utilized such a stressor (Stoker et al., 2017), a sound stressor was utilized. Thus, environmental stressors were managed via the addition of a noise distraction in the form of a repeating beep. A sound system was placed 8 foot away from the performer and played a beep 12 times per minute at a volume of 80 decibels (cf. Stoker et al., 2017).

In conditions where consequence stressors were introduced, this was achieved via manipulating forfeit, judgment, and reward stressors (cf. Bell et al., 2013; Driskell et al., 2014; Lawrence et al., 2014; Oudejans & Pijpers, 2009; Stoker et al., 2016; Stoker et al., 2017). In the forfeit condition, the participants were required to perform a staged media conference if they did not achieve their required score. During this forfeit, the athlete was required to answer questions for five minutes in front of an audience consisting of the Performance Director, coaches, and some members of the management team. The questions related to why they had failed to hit their required score, and the audience were primed and provided with a list of questions created by the coaches, such as “why do you think you failed the challenge?”, to help ensure that there was a consistently tough but supportive climate (cf. Bell et al., 2013) across the interviews. In the reward condition, the participant with the highest score across all of the reward conditions received £200 at the end of the experiment

(Oudejans & Pijpers, 2009). In the judgment condition, the Performance Director was present during the exercise and was positioned six feet away, facing the athlete. Participants were shown a document which was used by the Performance Director to evaluate them (scores out of 10) on their ability to handle the pressure of the task, ability to focus on the task, and motivation towards the task (cf. Stoker et al., 2017).

Measures. Previous pressure research within and outside of sport settings (e.g., Kinrade, Jackson, & Ashford, 2015; Reeves et al., 2007) has assessed perceptions of performance pressure using a self-report, Likert-type scale. In line with this research, a self-report scale was adopted in the present study where 1 indicated "no pressure" and 7 indicated "extreme pressure". Additionally, as previous pressure research has examined heart-rate and self-reported anxiety to provide an indication of experiences under pressure (e.g., Oudejans & Pijpers, 2009; Stoker et al., 2017), these measures were also adopted in the present study. Regarding anxiety, previous literature has suggested that self-reported state anxiety may be an indicator of pressure to perform (cf. Mesagno et al., 2011). Specifically, previous studies of performance under pressure have measured anxiety using both shortened (Oudejans & Pijpers, 2009) and complete (Kinrade et al., 2015) questionnaires. While shortened and complete questionnaires have received criticism for lack of validity, abbreviated scales receive consistent support when expediency is paramount (Williams, Cumming, & Balanos, 2010). Consequently, the shortened Immediate Anxiety Measurement Scale (IAMS; Thomas, Hanton, & Jones, 2002) was used to measure anxiety in the present study. The IAMS is recognized as a valid and reliable method for assessing state cognitive anxiety, somatic anxiety, and self-confidence (Williams et al., 2010). The instrument contains three items that measure the intensity and direction of cognitive anxiety, somatic anxiety, as well as self-confidence. The scale contained one item for each of these constructs that included: "I am cognitively anxious", "I am somatically anxious", and "I am confident". Participants rated their experience of each of these items on a seven-point Likert scale ranging from 1 (not at all) to 7 (extremely). Respondents also rated the degree to which they perceived the intensity of each symptom to be either facilitative (+3) or debilitative (-3) towards performance. Consistent with previous research (e.g., Stoker et al., 2017), both intensity and direction dimensions were included in the instrument because of their potential to reveal different insights regarding the specific impact of the stressors used in the study. Heart-rate data was monitored using a Nexus-4 encoder (Mindmedia, 2004) and captured by means of Bluetooth to a laptop running Mind Medias Biotrace+ software. A Nexus-4 dedicated electrocardiogram (ECG) lead with silver nitride electrodes was positioned on the participants' skin in accordance with lead II chest placement guidelines (Mindmedia, 2004). The electrodes attached to the Nexus-4 encoder, which was positioned on the athlete's waist band. Raw data was collected at a sampling rate of 2000Hz and the average heart beats per minute (bpm) were calculated using Biotrace+ functions. Participants' average bpm was calculated from when the shooting exercise began to when their last shot had been taken, or when time had run out. Regarding performance, a Sius Ascor electronic system (SA 921, Sius Ascor, Effretikon, Switzerland) was used to measure the performance accuracy of each shot in relation to the center of the target.

Procedure

Prior to the start of the experiment, a group session took place with all of the participants. The study brief was provided to the athletes and consent was obtained. The IAMS items were discussed with the participants to ensure that they understood what each item represented and details regarding biofeedback measures were also discussed. In each condition, the Nexus-4 encoder heart-rate monitor was attached to the participant. It was then explained to the athletes that they would have 10 shots, over 10 minutes, to warm-up. The participants completed an IAMS and reported their perceived pressure before having their heart-rate data recorded as they performed the warm-up. This warm-up exercise was used to collect baseline scores. Following the warm-up, there was a break of five minutes before the participants performed the shooting exercise in a specific condition. Each participant was provided details of the specific condition of the exercise, including the stressors they would be exposed to, before they completed another IAMS and reported their perceived pressure. Participants then completed the condition whilst their heart-rate was recorded. In each condition, the participants performed the shooting exercise whilst exposed to the manipulated stressor. According to the condition, some stressors were administered prior to performing the shooting exercise (i.e., the performer stressor) and some were administered during the performance (i.e., the beep from the sound system). In conditions where there were consequences, condition-relevant stressors were delivered immediately following completion of the condition, with the exception of the reward condition. In the reward condition, the reward was administered on the last day of the experiment. This clause was made clear to participants when they received the condition explanation.

The experiment took place outside of a laboratory, in an applied shooting setting, so specific steps had to be taken to reduce confounding variables. The experiment took place in a shooting hall that was completely secluded and thus bereft of bystander observation. Excluding the judgment condition where the Performance Director was present, only the first and last authors were present during the conditions. Athletes were asked not to discuss their experiences with fellow participants until the study was complete. A script was followed for all conditions, to ensure the same narrative was delivered to each participant. All the conditions took place within the athletes' normal training hours. Athletes were restricted to completing only one condition per day and the experiment took place over three weeks.

Data Analysis

The independent variables were the task, performer, environmental, forfeit, reward, and judgment stressors manipulated across the conditions. The dependent variables were heart-rate, performance, and self-reported pressure, anxiety, and confidence. The overall baseline for each participant was calculated by averaging their own scores across the six warm-ups (i.e., the average of their score from the task condition warm-up, the performer condition warm-up, etc.). A one-way ANOVA with repeated measures was used to identify if there were differences amongst the means for pressure, heart-rate, self-reported anxiety (intensity and direction), confidence (intensity and direction), and performance between each pressure condition and the baseline. Partial eta squared (η_p^2) was used as an indicator of effect size for ANOVA calculations and a critical alpha level of .05 was set. Pairwise comparisons (p = <0.05) were performed to identify the conditions in which significant differences occurred. Bonferroni corrections were used to control for Type I error.

Results

Mean scores for perceived pressure, cognitive and somatic anxiety (intensity and direction), self-reported confidence (intensity and direction), heart-rate (bpm), and performance are presented below.

A significant main effect was found for perceived pressure, $F(6, 30) = 10.87$, $p <$ .001; $\eta_p^2 = .69$). Pairwise comparisons indicated that pressure was significantly higher in the forfeit ($M = 4.9$, $SD = 1.08$) and judgment condition ($M = 4.5$, $SD = .96$) as compared with the baseline ($M = 1.83$, $SD = .40$). In addition, scores in the forfeit condition were significantly higher than scores in the performer condition ($M = 2.8$, $SD = .65$). A significant main effect was found for performance score, $F(6, 30) = 5.78$, $p = <.001$; $\eta_p^2 = .54$). Pairwise comparisons showed that scores in the judgment condition ($M = 99.48$, $SD = 18.80$) and the task condition ($M = 99.15$, $SD = 16.05$) were significantly lower than scores in the baseline condition ($M = 102.07$, $SD = 20.04$).

A significant main effect was found for cognitive anxiety intensity, $F(6, 30) = 7.07$, $p = < .001$; $\eta_p^2 = .59$). Pairwise comparisons indicated scores in the forfeit ($M = 4.17$, $SD = .12$) and judgment condition ($M = 4.50$, $SD = 1.02$) were significantly higher than the baseline condition ($M = 1.05$, $SD = .05$). A significant main effect was also found for cognitive anxiety direction, $F(6, 30) = 5.07$, $p = .001$; $\eta_p^2 = .50$). With a mean value of -1.5 ($SD = .02$), anxiety in the judgment condition was interpreted as more debilitative than in the baseline condition ($M = .03$, $SD = .00$). In addition, there was a significant main effect for somatic anxiety intensity, $F(6, 30) = 3.33$, $p = .012$; $\eta_p^2 = .40$), confidence intensity, $F(6, 30) = 2.44$, $p = .049$; $\eta_p^2 = .74$), and heart-rate, $F(6, 30) = 3.96$, $p = .005$; $\eta_p^2 = .44$). However, following Bonferroni post hoc analysis, there were no significant differences found in the pairwise comparisons. There was no main effect for somatic anxiety and confidence direction.

Discussion

Building on previous literature (i.e., Mesagno et al., 2011) and specific to the PT framework generated by Stoker and Colleagues (2016; 2017), the present investigation was designed to examine the effects of manipulating a single task, performer and environmental (i.e., a training demand) forfeit, reward or judgment stressor (i.e., a consequence of training) on experiences of pressure. This research was conducted to provide further clarification regarding whether consequences are more effective than demand stressors at generating pressure and also by highlighting which specific, individual stressors have the greatest impact. This information would further provide insight regarding the most effective means of systematically creating pressure and could be useful for maximizing a coach’s or practitioner’s time, efforts, and resources when creating a pressurized training environment.

Results revealed that perceived pressure and cognitive anxiety intensity were significantly higher in two of the consequences conditions (i.e., the forfeit, and judgment condition), as compared with the baseline condition. Also, perceived pressure was significantly lower in the performer condition as compared with the forfeit condition. In previous literature, rewards, forfeits, and judgment stressors have been utilized as part of wider interventions and indicated to be important for creating pressure and anxiety (e.g., Bell et al., 2013; Mesagno et al., 2011; Reeves et al., 2007). Indeed, examples of forfeits have included physical or ego punishments, such as cleaning up the changing room, or missing a training session (Bell et al., 2013), and rewards have commonly taken the form of monetary incentives (Oudejans & Pjipers, 2009). Also, judgment stressors that increase pressure are indicated to include peer or coach evaluation (Driskell et al., 2014; Kinrade et al., 2015). Along these lines, wider research consistently supports consequences as an important factor when creating pressure, and results of the present study further extend knowledge from these investigations. Specifically, it was found that consequences were not merely important but, rather, essential for producing pressure as indicated by the fact that pressure was only ever increased when consequences were present.

In contrast to consequences, previous evidence has been more inconsistent regarding the role of training demands when creating pressurised training environments (Stoker et al., 2017). For example, there are examples of support, such as in literature indicating that coaches successfully utilized demand-based manipulations to create challenge and pressure (cf. Weinberg et al., 2011). As well as this support, it has been documented that coaches and researchers have manipulated demands to increase pressure. For instance, Oudejans and Pijpers (2009) successfully generated pressure by manipulating task and environmental stressors in such a way that participants had to perform a dart exercise from a height. On the other hand, however, there are also examples of demands being manipulated with no impact on performance pressure. When testing a coaching pressure training framework, for example, Stoker and colleagues (2017) manipulated training demands to find pressure and anxiety remained unaffected, unless consequences were also simultaneously introduced. Considering previous research in light of the current study, the presented findings highlight that manipulating task, performer, and environmental demand-stressors had no impact on pressure and anxiety experiences. Thus, in consideration of the PT coaching framework that underpinned this study (Stoker et al., 2016), these findings support previous research (Stoker et al., 2017) which indicates that manipulating the demands of training, in isolation, may not be effective at creating pressurized training environments. Indeed, considering the consistent support for consequences, there is an argument supporting the need to ensure any demand-based manipulations are coupled with consequences when desiring to increase pressure.

In the present study, regarding the most effective stressor at producing a pressurised environment, it was found that pressure and cognitive anxiety intensity were significantly higher in the forfeit and judgment condition while changes in the reward condition were not significant. Results therefore highlight that the potential reward (of £200) was not as impactful on experiences of pressure as the forfeit of having to perform a task in front of the team or the stressor of being judged by the Performance Director (PD) whilst performing. It was also found that levels of cognitive anxiety in the judgment condition were interpreted as significantly more debilitating than facilitating towards performance. Thus, there is an indication that manipulating judgment had the most overall impact of any stressor. This stressor may have had such a substantial effect on perceived pressure due to the fact that the PD's opinion, given their provision over important decisions like selection, is critical to success. Previous research also found support for judgment as an impactful stressor in pressurised training contexts. Specifically, Mesagno and colleagues (2011) found judgment stressors, such as performing in front of teammates, significantly increased anxiety in a high-pressure training context more so than a monetary reward. This research combines with the findings of the present study to suggest that judgment stressors, such as being watched by an important other, may present coaches with the most impactful stressor in pressurised training environments.

The judgment stressor also impacted upon performance negatively. Specifically, performing in front of the PD significantly decreased shooting accuracy, as compared with the baseline. Previous literature has documented similar findings. For instance, Lawrence et al. (2014) examined golf putts with and without consequences and discovered that the introduction of a judgment stressor could negatively impact performance. This finding could be an indication that the participants in the present study were unable to manage the increased pressure induced by the consequence and thus performance suffered. Specifically, in the present study, as well as performance being impeded, pressure and cognitive anxiety was significantly increased when the judgment stressor was introduced. Hence, bearing in mind that attempts to cope with pressure can be either successful or unsuccessful (Hill et al., 2010), it is possible that participants' efforts to manage the increased pressure were not effective. In terms of what led to the underperformance, it could be possible that increases in cognitive anxiety were the cause. Previous research supports this possibility (Mesagno et al., 2011), where performance has been negatively impacted in a high-pressure condition by increases in self-presentation as induced by judgment stressors. Notably, these results contrast with the findings of Stoker et al. (2017) where it was discovered that consequences did not impact performance. Specifically, elite netballers were exposed to consequences in a PT exercise and, while it was found that consequences impacted perceived pressure, they had no affect on performance. However, the netballers in Stoker and colleagues' (2017) study were accustomed to PT, whereas the sample in the present study did not. Hence, the specific experiences of the netballers, as opposed to the shooters in the present study, may have resulted in them being better equipped to manage pressure and thus provide a better performance. It is possible that the mixed findings seen within the present study and previous literature may be an indication that some participants manage pressure in such a manner that performance is maintained while others do not. Indeed, this is supported by research indicating that stressor familiarity facilitates better coping (Driskell & Johnston, 1998).

The demand-based task stressor also impacted accuracy, supporting previous research (e.g., Driskell et al., 2014) such as Stoker et al. (2017) which explored the same PT coaching framework and found that manipulating the training demands negatively affected shoulder-passing accuracy. This previous research also discovered a significant main effect for self-confidence intensity but post hoc analyses did not reveal significant differences amongst the conditions. Yet, observation of the means demonstrated a trend where confidence was lower in conditions where performance was significantly reduced. The results of the present study discovered the same finding, and wider research has indicated that better performances facilitate perceptions of increased confidence (Skinner, 2013), suggesting that confidence can be affected by the standard of performance. Thus, considering this previous research and the trends identified in the present study, there may be some support for the notion that demand stressors can mediate confidence due to their ability to affect performance.

Applied Implications

Results of the present study revealed that pressure only increased in conditions where consequences were introduced. Combining these findings with previous research (e.g., Lawrence et al., 2014; Mesagno et al., 2011; Oudejans & Pijpers, 2009; Reeves et al., 2007), collectively there is growing research indicating that consequences might be integral for creating pressure in training environments. Previous research has indicated that different types of consequences might induce contrasting types of choking. Specifically, reward and forfeits have been linked with distraction forms of choking, while judgment has been linked with self-focus methods of choking (DeCaro et al., 2011; Hill et al., 2010). Consequently, coaches and applied practitioners ought to consider PT as a method for increasing coping through using consequences to introduce pressure, which could focus on the introduction of forfeits and rewards, or judgment, depending on the type of choking that the athlete needs to overcome (cf. Mesagno et al., 2011).

Of all the stressors manipulated, the judgment stressor had the biggest impact on participants' experiences of anxiety and pressure. Hence, results of the present study highlight that consequences are essential when striving to create pressure. Moreover, within certain athlete populations, a specific category of consequence, such as judgment, might provide coaches with the most effective means for creating a pressurized training environment. This point is important for coaches looking to maximize their resources. With this in mind, specific to the condition of consequences, it is important to consider individual differences. For example, if a coach was planning to deploy judgment stressors, consideration could be lent to recipients' perceptions of significant others, relationships within the team, and their motives to impress. In addition, consequences involving key decision-makers influencing an athlete's selection, and individuals that can influence levels of self-consciousness could be considered (cf. Bell et al., 2013; Mesagno et al., 2011; Stoker et al., 2016).

As it was found that the manipulation of demand stressors made no difference to perceived pressure, findings also suggest that it might not be effective to rely upon these stressors in applied settings to produce pressure. Yet, these stressors always negatively impacted performance. Hence, collectively the findings indicate that demands and consequences may have distinct roles when PT. Specifically, while demand stressors could be critical for shaping performance, consequences appear essential for producing pressure. However, previous research such as Weinberg and colleagues (2011), supports the notion that coaches may rely on more demand-based manipulations as a means for creating pressure. Furthermore, literature has predominantly indicated consequences are important, but not essential, when creating pressure (e.g., Bell et al., 2013; Oudejans & Pijpers, 2009; Reeves et al., 2007). Therefore, there may be a need to expand knowledge in applied and scientific arenas regarding the distinct roles of demands and consequences when PT.

Although it was found that the demand stressors did not affect perceptions of pressure, coaches should consider other important effects that training demands have when PT. Increasing the demand stressors was found to negatively impact performance. In addition, while post hoc analyses did not reveal significant differences, a significant main effect was found for self-confidence intensity and means were observed to show that confidence was lower in conditions where performance was significantly reduced. In line with previous research that has found similar results (e.g., Stoker et al., 2017), and wider literature indicating that performance mediates perceptions of confidence (Skinner, 2013), the present results could suggest that demands are important when pressure training for enabling coaches to challenge performance and potentially mediate confidence. Also, when pressure training, previous research (Stoker et al., 2016) identified that coaches used the demands of training to expose athletes to challenges that mirrored competition. In this way, training demands may be important for facilitating the development of the ability to perform the specific skills needed for competition under pressure. Furthermore, research has suggested that similarity between training and competition demands can encourage transference of skills into the competition environment (e.g., Driskell et al., 2014). Thus, training demands appear to be instrumental for encouraging the transfer of skills from PT to competition. Also, literature has documented that individuals can lose psychological flexibility if they are repeatedly exposed to the same contextual demands due to the training task encouraging the repetition of a single behaviour (Driskell & Johnston, 1998). This is due to the athlete persisting with a single response, even when the behaviour is no longer correct. Hence, by varying training demands, these stressors can be used to promote adaptability and psychological flexibility while PT. Thus, collectively, demand stressors may be a critical component for influencing transferability, psychological flexibility, challenging performance, and, potentially, mediating confidence when PT; further research on confidence is needed so as to provide a definitive conclusion.

Limitations

Due to the difficulties associated with using an elite sample, such as limited access because of their training responsibilities, only six athletes participated in the study. Thus, the statistical manipulation will have been constrained by the small sample size. Another limitation of the study is that the conditions and stressors used were carefully designed with the specific participants in mind. Thus, caution should be taken when generalizing the findings to other participants or sports. An additional limitation of the study was that the time of day that the conditions took place varied. Consequently, circumstances may have led to athletes performing a condition first thing in the morning or at the end of the day. This scheduling challenge may have created variance in athletes' physiological and psychological experiences across the conditions. However, it was planned that this limitation would be counterbalanced by recording a baseline for each condition and using the average across these six conditions to form the final baseline. Likewise, athletes can be asked to compete at unusual times in major competitions, hence this variable also reflects the reality of elite sport.

Future Research

Methods for monitoring how individuals are experiencing a pressurised training session, in real-time, might be enhanced by incorporating more biofeedback. For instance, biofeedback is emerging as an increasingly popular tool in elite sport and, if further investigated, could provide a means for better assessing responses to pressure. Exemplifying this, previous research has revealed that heart-rate decelerates immediately prior to the execution of a closed-skill, such as pistol shooting, and Lacey and Lacey (1980) theorized why this occurred. Specifically, it was highlighted that this deceleration, which resulted in a more effective focusing of attention and superior performance, was associated with a decreased amount of feedback to the brain. In contrast, it was also theorized that heart-rate would accelerate if athletes explicitly monitored their skills, such as the movements of their arms during the putting stroke. With this research in mind, there is an argument for future studies to investigate heart-rate deceleration and self-focus theories of choking under pressure. Further research in this area could provide additional insights into psychophysiological activity and thus advance our understanding of methods for monitoring and managing responses under pressure.

In addition to advancing methods of monitoring, there is a need to conduct novel studies investigating longitudinal PT interventions as currently such literature is scarce (cf. Lawrence et al., 2014; Oudejans & Pijpers, 2009; Reeves et al., 2007). With this in mind, researchers are encouraged to develop knowledge on the most effective means for conducting PT over longer periods, such as an Olympic/Paralympic cycle, so as to better understand how PT can reduce choking under pressure. Additionally, such research could be accompanied by advances in approaches to analysis, which are also encouraged. For example, it has been indicated that one route from stressor to sub-optimal performance occurs via pressure increasing anxiety (Hill et al., 2010). Exploring these relationships and evidencing this progression, such as within a longitudinal PT intervention, would provide an insightful step forward for PT literature that moves beyond simply tracking how these measures increase and decrease over different time periods and situations.

Conclusion

Synonymous with previous research (Stoker et al., 2017), the findings of the present study revealed that pressure only increased in conditions where consequences were introduced. Notably, the judgment stressor had the greatest influence of all and, thus, may present coaches with the most effective consequence for maximizing pressure. It was also found that manipulating demand stressors in isolation did not influence pressure in any condition. Yet, these stressors always negatively impacted performance. Thus, collectively the findings support and build on Stoker and colleagues' (2016) framework by indicating that demands and consequences can have distinct roles when PT; demand stressors could be critical for shaping performance whereas consequences appear essential for producing pressure. These findings have important applied implications. First, previous research suggested that coaches might rely on demands, not consequences, to produce pressure (cf. Weinberg et al., 2011). Second, literature has predominantly indicated consequences are important, but not essential, when creating pressure (e.g., Oudejans & Pijpers, 2009). Therefore, there may be a need to expand knowledge in applied and scientific arenas regarding the potentially distinct roles of demands and consequences when PT. In light of these points, the results of the present study contribute findings to underpin methods for systematically creating and exposing athletes to PT environments. However, literature on this topic is still in its infancy and additional theory must be developed to ensure applied PT research is underpinned with comprehensive and empirical evidence.

References

Baumeister, R. F. (1984). Choking under pressure: Self-consciousness and paradoxical effects of incentives on skilful performance. *Journal of Personality and Social Psychology, 46*, 610–620.

Bell, J. J., Hardy, L., & Beattie, S. (2013). Enhancing Mental Toughness and Performance Under Pressure in Elite Young cricketers: A 2-Year Longitudinal Intervention. *Sport, Exercise, and Performance Psychology. 2*(4), 281-297. doi:10.1037/a0033129.

DeCaro, M. S., Thomas, R. D., Albert, N. B., & Beilock, S. L. (2011). Choking under pressure: Multiple routes to skill failure*. Journal of Experimental Psychology: General, 140*(3), 390.

Driskell, J. E., & Johnston, J. H. (1998). Stress exposure training. In J. A. Cannon-Bowers, & E. Salas (Eds.), *Making decisions under stress: Implications for individual and team training* (pp. 191 – 217). Washington, DC7 APA Press.

Driskell, T., Sclafani, S., & Driskell, J. E. (2014). Reducing the Effects of Game Day Pressures through Stress Exposure Training, J*ournal of Sport Psychology in Action, 5(*1), 28-43. doi:10.1080/21520704.2013.866603.

Hill, D. M., Hanton, S., Matthews, N., & Fleming, S. (2010). Choking in sport: A review. *International Review of Sport and Exercise Psychology*, *3*(1), 24-39.

Kinrade, N. P., Jackson, R. C., & Ashford, K. J. (2015). Reinvestment, task complexity and decision making under pressure in basketball. *Psychology of Sport and Exercise*, *20*, 11-19. doi:10.1016/j.psychsport.2015.03.007.

Knicker, A. J., Renshaw, I., Oldham, A. R., & Cairns, S. P. (2011). Interactive processes link the multiple symptoms of fatigue in sport competition. *Sports Medicine*, *41*, 307-328.

Lacey, B. C., & Lacey, J. I. (1980). Cognitive modulation of time-dependent primary bradycardia. *Psychophysiology*, *17*(3), 209-221.

Lawrence, G. P., Cassell, V. E., Beattie, S., Woodman, T., Khan, M. A., Hardy, L., & Gottwald, V. M. (2014). Practice with anxiety improves performance, but only when anxious: evidence for the specificity of practice hypothesis. *Psychological Research*, *78*(5), 634-650. doi:10.1007/s00426-013-0521-9

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*, 441-459. doi:10.1123/jsep.33.3.441.

Mesagno, C., Marchant, D., & Morris, T. (2008). A pre-performance routine to alleviate choking in "choking-susceptible" athletes. *The Sport Psychologist, 22*, 439-457.

Mindmedia. Manual. NeXus-10 user's guide. Roermond-Herten: Mind Media B. V. (2004).

Moore, L. J., Vine, S. J., Cooke, A., Ring, C., & Wilson, M. R. (2012). Quiet eye training expedites motor learning and aids performance under heightened anxiety: The roles of response programming and external attention. *Psychophysiology*, *49*(7), 1005-1015.

Oudejans, R. R., & Pijpers, J. R. (2009). Training with anxiety has a positive effect on expert perceptual–motor performance under pressure. *The Quarterly Journal of Experimental Psychology, 62*, 1631-1647. doi:10.1080/17470210802557702.

Provost, S. C., & Woodward, R. (1991). Effects of nicotine gum on repeated administration of the Stroop test. *Psychopharmacology, 104*(4), 536-540.

Reeves, J. L., Tenenbaum, G., & Lidor, R. (2007). Choking in front of the Goal: The effects of self-consciousness training. *International Journal of Sport and Exercise Psychology*, *5*(3), 240-254. doi:10.1080/1612197X.2007.9671834.

Skinner, B., (2013). The Relationship between Confidence and Performance throughout a Competitive Season, Utah State University Digital Commons, 4, 1.

Stoker, M., Lindsay, P., Butt, J., Bawden, M. & Maynard, I. (2016). Elite coaches' experiences of creating pressure training environments. *International Journal of Sport Psychology, 47*(3), 262-281.

Stoker, M., Maynard, I., Butt, J., Hays, K., Lindsay, P., & Norenberg, D. A. (2017). The effect of manipulating training demands and consequences on experiences of pressure in elite netball. *Journal of Applied Sport Psychology*, 1-15.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18*, 643-662.

Sius Ascor: Electronic Scoring systems (2010), http://www.sius.com/downloads/docu/Usermanual_System7_e.pdf.

Thomas, O., Hanton, S., & Jones, G. (2002). An alternative approach to short-form self report assessment of competitive anxiety. *International Journal of Sport Psychology*, 33, 325–336.

Vine, S. J., Moore, L. J., Cooke, A., Ring, C., & Wilson, M. R. (2013). Quiet eye training: A means to implicit motor learning. *International Journal of Sport Psychology*, *44*, 367–386.

Weinberg, R., Butt, J., & Culp, B. (2011). Coaches' views of mental toughness and how it is built. *International journal of sport and exercise psychology*, *9*(2), 156-172.

Williams, S. E., Cumming, J., & Balanos, G. M. (2010). The use of imagery to manipulate challenge and threat appraisal states in athletes. *Journal of Sport and Exercise Psychology*, *32*(3), 339-358.