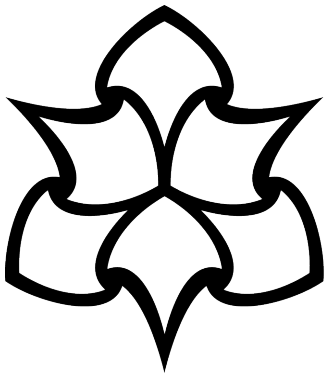

Investigating the Effects of Irrational and Rational Self-Statements on Motor-Skill and Hazard Perception Performance

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Abstract

Rational Emotive Behavior Therapy (REBT) is a psychotherapeutic approach based on the premise that when faced with adversity irrational beliefs determine unhealthy negative emotions and maladaptive behaviors, whereas rational beliefs lead to healthy and adaptive alternatives. The detrimental effects of irrational beliefs on psychological health are established, however less is known about the deleterious effects on human behavior and performance. In the present study we examined the effects of irrational and rational self-statements on motor-skill performance (Experiment 1), performance effectiveness, and efficiency during a modified hazard perception task, and task persistence during a breath-holding task (Experiment 2). Using a repeated measures counter balanced design, two cohorts of 35 undergraduate university students were recruited for Experiment 1 and 2, each participating in no self-statement, irrational, and rational self-statement conditions. Data indicated no differences in motor-skill and task performance, performance efficiency, task persistence, mental effort, and pre-performance anxiety between irrational and rational self-statement conditions. In contrast to previous research the findings provide insight into a juxtaposition that irrational beliefs hinder psychological health, yet may help performance, highlighting important distinctions in factual and practical rationality that have been overlooked within the extant literature. The findings have important practical implications for practitioners that may look to REBT to enhance the psychological health and performance for individuals who operate in high performance contexts. Further, the short and long-term effects of irrational and rational beliefs on performance and psychological health warrants greater investigation.

Key words: REBT, irrational beliefs, rational beliefs, behavior, emotion.

Investigating the Effects of Irrational and Rational Self-Statements on Motor-Skill and Hazard Perception Performance

Rational Emotive Behavior Therapy (REBT; Ellis, 1957) was created by Albert Ellis in 1955 and is summarized by the ancient proverb "people are not disturbed by things, but by the view they take of them" (Epictetus 55-135). Central to REBT is the premise that irrational beliefs lead to psychological disturbance, whereas rational beliefs lead to enhanced psychological well-being (David, Szentagotai, Eva, & Macavei, 2005). Using the ABCDE framework (Ellis, 1997), the process of REBT aims to identify the clients activating event (A) and elicit the relevant irrational beliefs (B) that lead to the corresponding unhealthy negative emotions and maladaptive behaviors (C). Irrational beliefs are then disputed (D) and replaced with rational alternatives (E), thus when encountering future adversities individuals will experience healthy negative emotions and adaptive behaviors that facilitate goal achievement (C; Dryden & Branch, 2008, Turner & Barker, 2014). Essentially, REBT allows the client to comprehend that in the face of failure, rejection, and poor treatment it is their beliefs that determine the functionality of their emotional and behavioral response (C), not the event (A). Irrational beliefs are characterized as extreme, rigid, illogical, and when encountering adversity (i.e., failure, rejection, or poor treatment) lead to unhealthy negative emotions (e.g., anxiety, depression) that propagate maladaptive behaviors (i.e., avoidance or escape-based behaviors) and hinders goal achievement (Dryden & Branch, 2008). Instead, rational beliefs are non-extreme, flexible, logical, and when encountering adversity are purported to lead to healthy negative emotions (e.g., concern, sadness) that facilitate adaptive behaviors (i.e., approach or assertive behaviors). When encountering adversity an individual's beliefs are central in determining the functionality of emotional and behavioral responses towards goal achievement (Ellis & Dryden, 1997), consequently having clear implications for those operating in performance contexts.

Presently there exists an extensive body of research demonstrating the association between irrational beliefs and psychological distress. To illustrate, a recent meta-analysis of 83 primary studies reported a moderate positive association between irrational beliefs and general distress (r = .36), depression (r = .33), anxiety (r = .41), anger (r = .25), and guilt (r = .29; Visla, Fluckiger, Holtforth, & David, 2016). Furthermore, the efficacy of REBT on psychological health has been supported with hundreds of studies and three previous meta-analyses (e.g., Engels, Garnefski, & Diekstra, 1993). Originally REBT was put forth as a clinical model of therapy, and despite much research demonstrating the association between irrational beliefs and deleterious emotional and behavioral consequences less is known about the effects of rational beliefs and/or irrational beliefs on human behavior and performance (Turner & Barker, 2014). This is surprising as REBT is widely considered to offer a model of human functioning (David, Freeman, & Digiuseppe, 2010). For those who operate in challenging and demanding contexts (e.g., business, elite sport, military) a rational philosophy (i.e., the endorsement of rational beliefs that are supported empirically, logically, and pragmatically) offers a pro-active approach that facilitates psychological health and goal achievement (Turner, 2016). Furthermore, the use of REBT has been reported across various performance settings such as, sport (e.g., Turner & Barker, 2014), education, and business (e.g., Criddle, 2007).

Rational beliefs are proposed to reduce excessive concerns of failure and likely to lead to a healthy negative emotion (e.g., concern) and exert a positive influence on performance (Kombos, Fournet, & Estes, 1989). Irrational beliefs are proposed to lead to an exaggeration of the importance of performing well and being accepted by others, which may lead to unreasonable and self-imposed demands that are largely unattainable (Bonadies & Bass, 1984). Furthermore, the anticipation that it would be “awful” (100% bad) when faced with failure, rejection, or poor treatment, may lead to an unhealthy negative emotion (e.g., anxiety)

and therefore hinder performance (Turner & Barker, 2014). Amongst the scant evidence base, Schill, Monroe, Evans, and Ramanaiah (1978) first evidenced that the adoption of irrational self-talk led to significantly more errors on a mirror-tracing task (i.e., reduced behavioral efficiency) compared to rational self-talk and control conditions. Additionally, the adoption of irrational self-talk has also been associated with reduced performance efficiency and increased anxiety during a mirror-tracing task, (e.g., Bonadies & Bass, 1984), as well as reduced performance during a series of trail making tasks (Kombos et al., 1989). Nevertheless, studies have reported only partial support for this hypothesis. For example, researchers have reported participants who adopted rational self-talk instead of irrational self-talk reported decreased anxiety, whilst reporting no differences in persistence during an insolvable performance task (e.g., Rosin and Nelson, 1983). Evidence indicates the adoption of irrational self-talk may hinder task performance and reduce behavioral efficiency, (e.g., Bonadies, & Bass, 1984; Kombos et al.; Schill, Monroe, Evans, & Ramanaiah, 1978), however, findings remain inconclusive due to a lack of critical mass and methodological shortcomings within the extant studies.

To explain, previous studies have largely relied upon the use of imagined rather than real stressful events, whereby irrational self-statements are thought to only activate during real-life and meaninful situations (e.g., Ellis, 1994). Previous studies have also: failed to include a control group (e.g., Bonadies & Bass, 1984), used leading statements (e.g., participants were told these statements would help reduce errors in performance; Schill et al., 1978), failed to discern the believability of the self-statements, and used performance tasks that lack in ecological validity (i.e., mirror-tracing task). Further, although researchers suggest that self-talk is better charatcerised in terms of directional interpretation (e.g., Hardy, 2006), no studies have yet matched the perceived helpfulness of irrational and/or rational self-talk statements with performance outcomes. On these grounds the investigation into the

effects of irrational and rational self-talk on performance warrants more rigourous examination.

Not restricted to experimental settings the effects of irrational beliefs and/or rational beliefs on performance have been tested through the examination of REBT on important psychological outcomes (i.e., anxiety, perceived control) and competitive performance in elite sport. For example, researchers indicated that reductions in irrational beliefs were coupled with reductions in cognitive anxiety (e.g., Turner & Barker, 2013), enhanced facilitative interpretations of anxiety (e.g., Larner, Morris, & Marchant, 2007), perceived psychological and performance benefits (Turner, Slater, & Barker, 2015), as well as short and long-term improvements in self-efficacy, perception of control, and athletic performance (A.G. Wood, Barker, & Turner, in press). Collectively, the applied data indicate irrational beliefs may hinder whereas rational beliefs may be helpful for athletic performance. However, little research has included objective markers to assess the effects of REBT on performance (Turner, 2016), as well the samples (i.e., elite athletes) constrain the external validity of the study findings across other performance settings. Ultimately, the effects of rational and irrational beliefs on important psychological outcomes, behaviors, and performance are yet to be established and require further enquiry (A. G. Wood et al., 2016).

In sum, there is a paucity of objective and empirical research that examines the effects of irrational beliefs and/or rational beliefs on performance. Moving beyond previous research methods and shortcomings, in the current study we aimed to conduct a rigorous examination into the effects of irrational and rational beliefs on behavior using measures of competitive performance. We add to the extant literature by examining the effects of irrational and rational self-statements on cognitions, emotions, and performance. To illustrate, in Experiment 1 we used a laboratory-based competitive golf-putting task as measure of motor-skill performance (e.g., Wulf & Su, 2007). In Experiment 2 we used a modified hazard

perception task as an objective measure of performance efficiency (visual search behavior) and performance effectiveness (hazard perception performance). In addition, a breath-holding task was used to measure task persistence.

Experiment 1

In Experiment 1 we examined the effects of irrational and rational self-statements on performance outcomes, pre-performance anxiety, concentration disruption, and the perceived helpfulness of self-statements. Previous research demonstrates that participants who adopt irrational self-statements record lower behavioral efficiency during a visual-spatial task compared to participants who adopt rational self-statements (e.g., Bonadies, & Bass, 1984; Kombos et al., 1989; Schill et al., 1978). Similarly, in Experiment 1 we used self-statements closely aligned with REBT theory (DiGiuseppe, Doyle, Dryden, & Backx, 2013) to promote irrational and rational performance approaches to a competitive golf-putting task (e.g., Wulf & Su, 2007) and assess performance. Addressing the limitations of past research (i.e., tasks lack in ecological validity) we used a motor-skill task as a measure of performance whilst controlling for participants total irrational belief scores. Furthermore, we incorporated: a real-life motivated performance situation rather than imagined scenario using competitive task instructions (e.g., Turner, Jones, Sheffield, & Cross, 2012), controlled for participants current (baseline) task proficiency, and ascertained participants perception of the self-statements in terms of helpfulness and believability. Based on previous research we hypothesized that when participants used irrational self-statements they would report higher-levels of pre-performance anxiety, higher performance concentration disruption, and achieve lower performance scores in the competitive golf-putting task compared to when they used rational self-statements. Finally, we hypothesized participants would perceive the rational self-statements to be more helpful towards the performance task, but report no differences in believability between self-statement conditions.

Method

Participants

Previous research most akin to the present study (i.e., examined effects of IBs, similar research design, & measures; Visla et al., 2016; Wilson, Wood, & Vine, 2009) reported moderate to large effects, thus supporting the expectation for medium effects. An apriori power analysis using (G*Power 3) showed that based on a medium effect size ($\eta^2 = .06$) and a power of .80 a minimum number of 28 participants were required for the present study. Thirty-five undergraduate students (26 = Male, 9 = Female) were purposively recruited at a UK university aged between 18 and 53 years (*M*age = *20.92, SD*age = *5.62)*. Institutional ethical approval and participant consent was obtained prior to all data collection, whilst a power analysis was considered as part of the peer review process.

Measures

Trait irrational beliefs. The Shortened General Attitudes and Beliefs Scale (SGABS; Lindner, Kirkby, Wertheim, & Birch, 1999) was used as a measure of total irrational beliefs . Consisting of 22-items, the total irrational belief subscale reported a good internal reliability score of $\alpha = .84$. The rational belief subscale consisted of 4 items and reported an unacceptable internal reliability score of $\alpha = .38$ and was omitted from the data analysis process. Participants reported on a 5-point Likert-scale ranging from 1 (*strongly disagree)* to 5 *(strongly agree)* the extent they agreed with each statement.

Pre-performance anxiety. The State Trait Anxiety Inventory (STAI; Spielberger, 1983) includes 20-items which assess pre-performance state- anxiety. Participants reported their answers on a 4-point Likert-scale ranging from 1 (*not at all*) to 4 (*very much so*). A Cronbach's alpha coefficient reported an excellent internal reliability score $\alpha = .93$.

Concentration disruption. Items associated with concentration disruption subscale were taken from the Sport Anxiety Scale-2 (SAS-2; Smith, Smoll, Cumming, & Grossbard, 2006) measuring concentration during the competitive performance task. Participants reported on a 4-point Likert-scale ranging from 1 (*not at all*) to 4 (*very much so*). The concentration disruption subscale consisted of four-items and reported an excellent reliability score of $\alpha = .93$.

Golf putting performance. The competitive performance task consisted of 10 putts. The target consisted of a putting hole worth 10 points, surrounded by 4 concentric circles separated at 5 cm intervals. Each concentric circle from the centre hole were scored with 8, 6, 4, and 2 points respectively. Zero points were scored if, the ball landed outside of the outermost concentric circle or participants exceeded the 10 seconds time limit allocated to each competitive putt. A maximum of 100 points and a minimum of 0 points were available for the 10 competitive putts for each experimental condition.

Task engagement. To discern participant's motivation towards the competitive performance task, engagement was measured using a single item on a 7-point Likert scale ranging from 1 (*not at all*) to 7 (*completely*).

Self-statement perception. Participants' perceptions (i.e., the helpfulness, believability, and engagement) of the self-statements were determined using three items on a 7-point Likert-scale ranging from 0 (not at all) to 7 (completely).

Procedure

Participants attended the lab individually on three separate occasions, first completing a baseline condition (A; no self-statements), then completing irrational (B) and rational (C) self-statement conditions in a counterbalanced design (ABC/ACB; Foley, 2004; see Figure 1).

Laboratory set-up. Prior to attending the lab a survey link using Qualtrics software (Copyright © 2015) was distributed via email to all participants' to collect total irrational

belief scores. On arrival participants were briefed on the research protocol and the expectations of their involvement. To control for learning effects participants were first familiarized to the golf-putting task during the baseline condition.

Competitive task instructions. Competitive task instructions were first read to the participants to create a motivated performance situation (e.g., Turner et al., 2012). The instructions emphasized the task demands prior to the performance task and minimized possible reductions in task motivation and effort over successful trials (e.g., Wilson et al., 2009). Specifically, the participants were informed that their scores would be compared and ranked on a publically available leader board, and the winner for each condition would be awarded a £25 cash prize (e.g., Barker, Jones, & Greenlees, 2010). The task instructions also emphasized the time-constraints, uncertainty, evaluation, and effort that would be required to complete the performance task.

Self-statements. Following the task instructions during the baseline condition, participants were asked to self-report their pre-performance anxiety and motivation towards the upcoming golf-putting task. Instead for irrational and rational self-statement conditions, prior to completing the self-report measures participants were asked to engage with, and adopt a set of self-statements. Each set consisted of one self-statement for each of the four core beliefs central to REBT theory (Dryden & Branch, 2008). The extent to which self-statements were understandable was examined in a pilot study ($N = 8$) with minor structural and content alterations being made. Self-statements were worded in reference to the content area of 'achievement' and the competitive golf-putting task (available on request from the first author). Specifically, irrational and rational beliefs each consist of four core beliefs that are dichotomously matched and are related to a single content area (e.g., control, comfort, achievement; DiGiuseppe et al., 2013). Irrational beliefs consist of the core beliefs of: demandingness (e.g., "I really would like to be successful, therefore I must"), low-frustration

tolerance (e.g., “If I am not successful it would be intolerable”), awfulizing (e.g., “if I was not successful it would awful”), and self/other/life-downing (e.g., not being successful would make me a complete failure”). Instead, rational beliefs consist of the four core beliefs of: preferences (e.g., “I would like to be successful, but that does not mean I have to”), anti-awfulizing (e.g., “not being successful would be bad but certainly not terrible”), high-frustration tolerance (e.g., although I would like to be successful, not being so would be tolerable”), and unconditional self-acceptance (e.g., not winning does not make me a complete failure, only that I have failed this time and this shows that I am a fallible human being”). To check understanding of the self-statements participants were asked to detail and summarize the content in their own words. Following this, participants then self-reported their pre-performance anxiety and motivation towards the upcoming golf-putting task.

Golf-putting performance task. After completing the questionnaires participants were instructed when to begin and that the task would end when they had played all 10 golf putts. Immediately prior to the golf-putting task participants were reminded that their performance was being video recorded and was to be evaluated by an expert golfing coach, that they only had 10 seconds to play each putt, and that their score would be placed on leader board that was accessible to all participants. Between every two putts they were instructed to engage with the self-statements by using a cue card located next to the putting position.

Data Analysis

Prior to the main analyses data screening procedures were completed. To limit the effect of outlying values, self-report data with Z score values greater than ± 3 were winsorized and replaced with the smallest or highest untrimmed score (Keselman, Algina, Lix, Wilcox, & Deering, 2008). A Shapiro-Wilks test was conducted on all data sets to test for assumptions of normality. A one-way analysis of co-variance was completed to compare the effects of irrational and rational self-statements (condition - predictor variable) with

dependent variables while controlling for baseline scores (baseline covariate) and the effects of total irrational beliefs (covariate). Preliminary checks were conducted to ensure that there was no violation of assumptions of normality, linearity, homogeneity of variances, homogeneity of regression slopes, and reliable measurement of the covariate. In the instance dependent variables were correlated a multivariate analysis of co-variance was performed (Mertler & Vannatta, 2002). Preliminary assumption testing was conducted to check for normality, linearity, univariate, and multivariate outliers, homogeneity of covariance matrices, multicollinearity, and no covariates were highly correlated with one another ($r >$ .08). Effect size values (eta squared) were interpreted in line with guidelines presented by Cohen, (1988): 01 = small effect, .06 = moderate effect, .14 = large effect.

Results

Preliminary Analyses

Manipulation checks. To test the participants understanding of the self-statements the content of the written summaries were subjectively assessed by the lead author in accordance to the four core beliefs central to REBT theory (Dryden & Branch, 2008). To test whether the participants' irrational and rational beliefs during the golf-putting task was successfully manipulated, the participants adoption of irrational and rational self-statements were examined using a single 'engagement' item on the self-statement perception scale. Statistical analysis revealed that regardless of the condition participants were engaged with the self-statements ($M = 4.44$, $SD = 1.34$), $t(69) = 27.80$, $p < .001$. In addition, statistical analysis revealed participants did not differentiate in engagement with the self-statements between irrational ($M = 4.37$, $SD = 1.44$), and rational ($M = 4.51$, $SD = 1.25$) self-statement conditions, $F(1, 33) = .33$, $p = .57$.

Task engagement. The participant's engagement towards the golf-putting performance task was assessed using a single item on a self-report scale. Statistical analysis

revealed that regardless of the condition participants were motivated towards the golf-putting performance (M = 5.30, SD = .89), $t(104) = 61.16$, $p < .001$. Further, participants did not differ in task engagement between baseline (M = 5.29 SD = .83), irrational (M = 5.23, SD = .88), and rational (M = 5.37, SD = .98) self-statement conditions, $F(2, 33) = .35$, $p = .71$.

Main Analyses

Three one-way analyses of covariance were used to investigate differences in golf-putting performance, performance anxiety, and concentration disruption between irrational and rational self-statement conditions. After adjusting for baseline scores and trait irrational beliefs, analysis revealed no significant differences in putting performance $F(1, 32) = 2.27$, $p = .14$, Wilks' Lambda =.93, $\eta^2 = .07$, performance anxiety, $F(1, 32) = .41$, $p = .53$, Wilks' Lambda =.99, $\eta^2 = .01$, and concentration disruption, $F(1, 32) = .13$, $p = .73$, Wilks' Lambda =.99, $\eta^2 = .01$(see Table 1).

A multivariate analysis of covariance was conducted to investigate whether participants differed in their perceived helpfulness and believability of irrational (ISS) and rational self-statements (RSS). After controlling for the effect of trait irrational beliefs analysis revealed no significant effects for perceived helpfulness (ISS - M = 3.66, SD = 2.26; RSS - M = 3.43, SD = 1.79) and believability (ISS - M = 4.46, SD = 1.88; RSS - M = 5.03, SD = 1.48), $F(2, 32) = 1.15$, $p = .33$, Wilks' Lambda =.93, $\eta^2 = .07$.

Discussion

Past literature has suggested that irrational beliefs should hinder performance, while rational beliefs should help performance, but research to date has not examined acute skilled performance as conducted in the current study. In sum, data evidenced no differences in motor skill performance, pre-performance anxiety, concentration disruption, perceived helpfulness, and believability of the statements between the irrational or rational self-statement conditions. Data do not support the study hypotheses or previous research findings

(e.g., Bonadies, & Bass, 1984; Kombos et al., 1989; Turner & Barker, 2013), indicating that acute performance was not differentiated by irrational and rational approaches to a competitive task. Further, participants perceived no differences in the helpfulness of irrational and rational self-statements towards the competitive golf-putting task. Nevertheless, performance outcomes alone (e.g., task score) may not fully reflect the complexity of skilled performance. For example, previous research used visual spatial tasks (e.g., mirror tracing) as a measure of performance efficiency, indicating that irrational self-talk led to reductions in performance efficiency (e.g., Bonadies & Bass, 1984; Schill et al., 1978), but not necessarily competitive performance outcomes. In contrast to previous research (e.g., Rosin & Nelson, 1983), the results also show the adoption of irrational self-statements did not determine higher levels of pre-performance anxiety or concentration disruption compared to rational self-statements. This may be explained by first, contemporary REBT theory posits healthy (e.g., concern) and unhealthy negative emotions (e.g., anxiety) are distinguished by functionality rather than the intensity (Hyland & Boduszek, 2012). Hence, we may expect to observe changes in functionality via the assessment of participant's perceived helpfulness of anxiety. Second, the measurement of anxiety via self-report may not accurately reflect pre-performance emotional responses due to social desirability (e.g., Williams & Krane, 1992), thus more objective markers are warranted. Previous research has evidenced greater physiological arousal (measured via Galvanic Skin Response) when adopting irrational self-statements compared to rational self-statements (e.g., Master & Gershman, 1983). Therefore, objective markers of physiological arousal may yield more accurate findings. Accordingly, a more refined and detailed investigation into the precise influence of irrational and rational self-statements across various psychophysiological outcomes and performance indicators (e.g., efficiency, task persistence, objective outcomes) is warranted.

Experiment 2

In this experiment we examined the effects of irrational and rational self-statements on measures of performance efficiency and effectiveness, task persistence, and competitive task performance outcomes, extending Experiment 1, which measured task performance outcomes only. In Experiment 2 we measured visual gaze behavior (measuring performance efficiency and effectiveness) during a competitive Hazard Perception Task (HPT; phase one) and persistence during a Breath Holding Task (BHT; phase two). In line with Experiment 1, pre-performance anxiety and concentration disruption were measured. Further building on Experiment 1, heart rate and perceived helpfulness of anxiety were also measured to provide an objective measure of physiological arousal and a directional measure of pre-performance anxiety respectively.

According to the processing efficiency theory (PET; Eysenck & Calvo, 1992) emotions such as anxiety may take up available processing resources in the working memory, in turn hindering performance efficiency. However, decrements in efficiency may not be reflected in performance outcomes (e.g., task score), as performance can be maintained (Wilson, Smith, Chattington, Ford, & Marple-Horvat, 2006). Using a hazard perception task, previous research has evidenced a quicker ability to fixate on a hazard after its appearance underpins hazard perception performance (Crundall et al., 2012). In addition, researchers have also shown an increase in fixation duration to a detected hazard is also indicative of performance effectiveness and increased attentional capture (Garrison & Williams, 2013). Moving beyond Experiment 1, this was the first study to use markers of visual search behavior as an objective measure of performance efficiency and effectiveness, thus providing a rich dynamic source of psychological processes during the competitive hazard perception task (Richardson & Spivey, 2004).

Past laboratory research (e.g., Rosin & Nelson, 1983) indicated no differences in task persistence between irrational and rational self-statements. However, researchers suggest that irrational beliefs may be acutely motivational on the approach to an important competitive event, and therefore may lead to greater persistence (Turner, 2016). Further, REBT practitioners have indicated that irrational beliefs such as "I must succeed" may be considered motivational by performers (Turner & Barker, 2014). Therefore in Experiment 2, alongside measuring participants perceived mental effort, a Breath Holding Task (Hajek, Belcher, & Stapleton, 1987) was used as a raw measure of task persistence whilst tolerating discomfort (e.g., Sütterlin et al., 2013).

Drawing on the aforementioned literature we propose a series of hypotheses for Experiment 2. First, participants using irrational self-statements would record reduced performance efficiency, in terms of decreases in both fixation durations to the detected hazard and ability to fixate on the hazard after its appearance (i.e., time elapsed between hazard appearance and first hazard fixation; Crundall et al., 2012). Second, participants would record worse performance outcomes (hazard perception score) when adopting irrational self-statements compared to rational self-statements. Finally, participants who adopted irrational self-statements would also record greater task persistence, greater mental effort, higher anxiety intensity, lower perceived helpfulness, and increased physiological arousal (i.e., increased heart rate) compared to when using rational self-statements.

Method

Participants

As in Experiment 1, the effect sizes reported in research similar to the present study (e.g., Williams & Cumming, 2012; Wilson et al., 2006) reinforced the expectation for medium effects. Based upon an apriori power analysis, 35 undergraduates (26 = Male, 9 = Female) were purposively recruited at a UK university and were aged between 18 and 30

years (Mage = 21.09, SDage =2.92). All held a full UK driving license and had been driving for a minimum of 6-months. None of the participants had visual or hearing impairments that impeded their ability to complete the tasks.

Measures

As used in Experiment 1, measures of trait irrational beliefs were collected using the SGABS (α = .84).

Pre-performance anxiety. To ascertain levels of pre-performance anxiety and reduce completion time the STAI was reduced from 20 to 10 items. These 10 items were selected based upon the best psychometric properties within the State Trait Anxiety Inventory (STAI Form Y; Spielberger, 1983) as validated within the State Trait Personality Inventory (STPI; Spielberger & Reheiser, 2009). A Cronbach's alpha coefficient reported excellent internal reliability (α = .90). Participants also reported on a 7-point Likert-scale ranging from -3 (*Not at all helpful*) to 3 (*Extremely Helpful*) the directional interpretation of their pre-performance anxiety in relation to the upcoming competitive task.

Physiological arousal. Participants heart rate were measured using a MP45 Biopac (Biopac Systems Inc. 2016) to provide an objective and accurate assessment of physiological arousal on approach to both competitive performance tasks (HPT and BHT). A Biopac Analysis software (Biopac Systems Inc. 2016) ascertained changes in heart rate scores between baseline phase (after receiving the self-statements and before the pre-performance preparation phase) and pre-performance preparation phase (between starting pre-performance preparation and immediately prior to beginning the task).

Hazard perception performance. A HPT provided an objective measure of task performance (i.e., response time), specifically measuring participants' ability to quickly perceive and respond to a potentially dangerous driving situation (G. Wood, Hartley, Furley, & Wilson, 2016). Hazard perception scores were marked out of 20 and measured using

response times (milliseconds) between the onset of the hazard and when the participant indicated the presence of a hazard (mouse click). Participants were provided with a window of 5000 milliseconds and in the instance a click was not registered 0 points were awarded. Scores from each clip were summed to produce a final performance score. Hazard perception performance was assessed using three hazard perception clips each containing one major developing hazard - lasting between 55 and 60 seconds. Each clip was: specific to driving, featured everyday road scenes, contained one developing major hazard, and was fully counterbalanced between conditions.

Eye tracking and fixation analyses. Participants' visual search behavior during the appearance of the major hazard provided an objective indicator of performance efficiency and effectiveness (Garrison & Williams, 2013). First, fixation duration to the detected hazard was measured as an indicator of attentional capture and a predictor of effective hazard perception performance (G. Wood et al., 2016). Specifically, fixation duration was calculated as a change score of mean fixation duration between the baseline phase (total clip length prior to onset of the major hazard) and during the presence of the major hazard. Mean scores were calculated across three hazard perception clips. In addition, the time taken to fixate on the major hazard after its appearance was measured as an indicator of performance efficiency and predictor of effective hazard perception performance (Crundall et al., 2012). Time taken to fixate on the hazard was calculated as a mean time elapsed between the appearance of the major hazard and time of first fixation towards the hazard location (milliseconds). A fixation was defined as a gaze that remained on a single location for longer than 100ms and the frequency of the gaze was calculated as the mean number of times a location was fixated on (milliseconds; Garrison & Williams, 2013). SR Research Ltd. Experiment Builder software (Copyright 2016) monitored patterns of visual gaze behavior via the Eye Link 1000 sampling

at a rate of 2000 Hz that recorded monocular gaze direction with an accuracy of 0.25 – 0.5 degrees.

Breath-holding task. The BHT (Hajek, Belcher, & Stapleton, 1987) provided a behavioral indicator of task persistence whilst tolerating discomfort (e.g., Sütterlin et al., 2013). Breath holding performance scores were measured in seconds from when the participant initiated the first inhalation until the first exhalation. Participants' compliance with the BHT was measured on a 9-point Likert-scale (a) to what degree they followed the instructions precisely, (b) to what degree they tried to hold their breath as much as possible, and (c) whether they could hold their breath for any longer (Sütterlin et al., 2013).

Perceived mental effort. The Rating Scale Mental Effort (RSME; Zijlstra, 1993) provided a validated uni-dimensional measure of mental effort. After the completion of both HPT and BHT participants were required to indicate on a continuous vertical scale the amount of mental effort invested within the task. The scale consists of anchor points ranging from 0 (*Absolutely no effort*), 75 (*moderately effortful*) to 150 (*Extreme effort*).

Manipulation checks and task engagement. As in Experiment 1, perceptions of self-statements were collected in reference to both HPT and BHT. Furthermore, Participants' motivation towards both competitive performance tasks was measured using a single item. In line with previous research increases in heart rate were also measured using MP45 Biopac (Biopac Systems Inc. 2016) to provide an objective indicator of participant's engagement with the HPT (e.g., Turner et al., 2012).

Procedure

As in Experiment 1, measures of total irrational beliefs were collected prior to arrival**.** Participants then attended the lab individually on three separate occasions in a counterbalanced design (ABC/ACB; Foley, 2004). Experiment 2 spanned two phases with the study procedure (see Figure 1) repeated for both the HPT (phase one) and BHT (phase two)

in one testing session (see Figure 1). Data collection was completed using a combination of on-screen instructions and verbal cues from the researcher (Lead author). Psychological data was collected using an external laptop positioned in close proximity to the participants seating position. Using the Biopac software participants were fitted with electrodes to continuously monitor participants' heart rate(s) throughout the entirety of Experiment 2.

Phase one. On arrival participants were calibrated to the eye tracker using a 9-point grid displayed on the computer screen. Once calibrated, participants were provided with on screen instructions and a familiarization hazard perception clip. The provision of self-statements or no self-statements followed the procedures used in Experiment 1. Participants, were asked to summarize the content of the self-statements in the their own words before self-reporting the intensity and perceived of helpfulness of their pre-performance anxiety, as well as their motivation towards the upcoming task. Prior to the HPT participants were asked to take a few moments to re-familiarize and engage with the given set of self-statements, or to think (baseline) and prepare themselves for the upcoming performance (specific instructions available from the first author). Immediately prior to and between each of the three randomized hazard perception clips participants were re-calibrated using drift correct measures. On completion, participants remained connected to the MP45 Biopac to monitor heart rate(s) before proceeding to phase two.

Phase two. As in phase one, participants were asked to read a new set of competitive instructions regarding the BHT and provided with verbal instructions on how to complete a BHT. Specifically, participants were asked to sit comfortably on a chair, to pinch their nose, and asked to hold their breath for as long as possible, even if they felt the urge to breathe again (Sütterlin et al., 2013). Once familiarized and practiced with this technique the participant was provided and asked to adopt self-statements that were tailored to their performance in the BHT. As used in phase one, participants then completed a series of self-

report measures before taking a moment to re-familiarize and engage with the self-statements and prepare for the BHT. At the end, participants were asked to complete measures of perceived mental effort and compliance with the BHT. Additionally, in reference to both the hazard perception and breath-holding task participants self-reported their perceptions of the self-statements.

Data Analysis

The statistical analysis procedures followed those use in Experiment 1fgreen

Results

Preliminary Analyses

Manipulations check. All 35 participants indicated successful understanding of the self-statements. In reference to both hazard perception and breath-holding tasks, statistical analysis revealed regardless of the condition participants were equally engaged with the self-statements ($M = 4.37$, $SD = 1.64$), $t(69) = 22.26$, $p < .001$. Analysis also indicated engagement with the self-statements did not differ between irrational and rational self-statement conditions after controlling for trait irrational beliefs, $F(1, 33) = 2.84$, $p = .10$.

Task engagement. As in Experiment 1, statistical analysis was conducted to test participant's motivation towards both hazard perception and breath-holding tasks using a single self-report item. Analysis of self-report data revealed regardless of the condition participants were engaged with both the HPT ($M = 5.23$, $SD = .97$), $t(104) = 55.05$, $p < .001$ and BHT ($M = 5.07$, $SD = 1.32$), $t(104) = 39.41$, $p < .001$. Furthermore, analysis indicated engagement with the self-statements did not differentiate between baseline, irrational, and rational self-statement conditions in both HPT, $F(2, 33) = .22$, $p = .81$ and BHT, $F(2, 33) = .415$, $p = .66$. Statistical analysis also revealed regardless of the condition participants were engaged with the HPT, as indicated by mean increases in heart rate scores ($M = 2.67$, $SD = 4.91$), $t(104) = 5.58$, $p < .001$. In addition, participants did not differentiate in heart rate

increases between baseline (M = 3.06, SD = 5.69), irrational (M = 2.35, SD = 4.39), and rational self-statement conditions (M = 2.61, SD = 4.68), $F(2, 33) = .20$, $p = .82$. Statistical analysis showed regardless of the condition participants reported compliance with the BHT, as indicated by three items on a BHT compliance measure (M =6.28, SD = 1.46), $t(104) = 44.08$, $p < .001$. Furthermore, analysis indicated participants did not differ in BHT compliance between baseline (M = 6.11, SD = 1.56), irrational (M = 6.35, SD = 1.56), and rational self-statement conditions (M = 6.39, SD = 1.29), $F(2, 33) = .86$, p = .68.

Main Analyses

The main analyses are presented in three sections. The effects of irrational and rational self-statements on outcomes measures are reported in reference to the modified HPT and BHT in the first two sections (see Table 1). The final section reports participant's perceptions of helpfulness and believability of the self-statements between irrational and rational conditions.

Hazard perception task.

Hazard perception performance. To test the effects of irrational and rational self-statements on hazard perception performance a one-way analysis of covariance was conducted. Statistical analysis reported no significant differences between irrational and rational self-statement conditions after controlling for trait irrational beliefs and baseline scores, $F(1, 32) = .94$, $p = .18$, $\eta^2 = .06$.

Visual gaze behavior. To examine the effects of irrational and rational self-statements on participant's performance efficiency, after adjusting for baseline and trait irrational beliefs two one-way analyses of covariance were conducted. Analysis revealed no significant main effects between self-statement conditions in mean fixation duration during the presence of the major hazard, $F(1, 32) = .58$, $p = .45$, $\eta^2 = .02$. Further statistical analysis also revealed no

significant differences in time taken to first fixation of the major hazard, $F(1, 32) = .59$, $p = .45$, $\eta^2 = .02$.

Pre-performance anxiety. Two one-way analyses of covariance were used to investigate differences in the intensity and the directional interpretation of pre-performance anxiety between irrational and rational self-statement conditions prior to the HPT. After controlling for trait irrational beliefs and baseline scores analysis revealed no significant differences in intensity, $F(1, 32) = .08$, $p = .78$, Wilks' Lambda =.99, $\eta^2 = .00$, the directional interpretation of pre-performance anxiety, $F(1, 32) = .62$, $p = .44$, Wilks' Lambda =.98, $\eta^2 = .02$.

Physiological arousal. To examine the effects of irrational and rational self-statements on participant's physiological arousal a one-way analysis of covariance was conducted. No significant effects were found in heart rate between conditions after controlling for trait irrational beliefs and baseline scores, $F(1, 32) = 1.82$, $p = .67$, $\eta^2 = .01$.

Breath-holding task.

Task persistence and perceived mental effort. Two one-way analyses of covariance were used to examine differences in task persistence and perceived mental effort between irrational and rational self-statement conditions during a BHT. After controlling for trait irrational beliefs and baseline scores analysis revealed no significant differences in task persistence $F(1, 32) = 1.63$, $p = .21$, Wilks' Lambda =.95, $\eta^2 = .05$, and perceived mental effort $F(1, 32) = 3,81$, $p = .06$, Wilks' Lambda =.89, $\eta^2 = .11$,

Pre-performance anxiety. Two one-way analyses of covariance were used to investigate differences in the intensity and the directional interpretation of their pre-performance anxiety between irrational and rational self-statement conditions prior to the BHT. After adjusting for trait irrational beliefs and baseline scores analysis revealed no significant differences in intensity, $F(1, 32) = .31$, $p = .58$, Wilks' Lambda =.99, $\eta^2 = .01$, the

directional interpretation of pre-performance anxiety, $F(1, 32) = .56$, $p = .46$, Wilks' Lambda $=.98$, $\eta^2 = .02$.

Physiological arousal. To examine the effects of irrational and rational self-statements on changes in physiological arousal, as measured by changes in heart rate a one-way analysis of co-variance was conducted. After controlling for total irrational belief scores and baseline scores, analysis revealed no main effects between irrational and rational self-statement conditions, $F(1, 32) = 1.67$, $p = .21$, $\eta^2 = .05$.

Self-statement perception. Statistical analysis was conducted to examine participants perceived helpfulness of the self-statements between irrational and rational conditions for both the hazard perception and breath-holding task. After controlling for total irrational belief scores, a one way analysis of co-variance reported no significant effect in perceived helpfulness for both HPT, $F(1, 33) = 2.41$, $p = .13$, $\eta^2 = .07$, and the BHT, $F(1, 33) = 1.86$, $p = .18$, $\eta^2 = .05$. The results indicate irrespective of the condition participants reported no difference in perceived helpfulness between the rational self-statements (RSS) and irrational self-statements (ISS) for both the HPT (RSS - $M = 4.83$, $SD = 1.40$; ISS - $M = 3.46$, $SD = 1.82$) and BHT (RSS - $M = 4.86$, $SD = 1.48$; ISS - $M = 3.77$, $SD = 1.94$). In reference to both hazard perception and BHT a one-way analysis of covariance reported significant differences in the believability of self-statements between irrational ($M = 3.74$, $SD = 1.82$) and rational self-statements ($M = 5.17$, $SD = 1.48$) after controlling for trait irrational beliefs, $F(1, 33) = 1.66$, $p = .21$, $\eta^2 = .05$.

Discussion

Experiment 2 sought to extend the findings from Experiment 1 by assessing the effects of irrational and rational self-statements on objective measures of performance and performance efficiency during a competitive hazard perception task; as well task persistence during a breath-holding task. As in Experiment 1, data indicate no differences in competitive

performance, performance efficiency, task persistence, mental effort, and pre-performance anxiety (self-reported and heart rate) between irrational and rational self-statement conditions.

REBT theory indicates the endorsement of rational beliefs is unhelpful, whereas irrational beliefs hinder performance (Dryden & Branch, 2008). In Experiment 2 both fixation duration to detected hazard and time taken to fixate on the major hazard were assessed as objective and sensitive indicators of performance efficiency predictive of hazard perception performance (G. Wood et al., 2016). The present findings indicate no differences in performance effectiveness and efficiency between irrational and rational self-statement groups and accordingly support the results of Experiment 1, whilst contrasting with data from previous studies (e.g., Bonadies & Bass, 1984; Kombos et al., 1989; Schill et al. 1978). To further understand the effects of beliefs Turner and Barker (2014) suggested when encountering adversity (i.e., sporting competition) irrational beliefs may harbour motivational qualities. However, in-line with previous research (e.g., Rosin & Nelson, 1983) both task persistence and perceived mental effort were not differentiated by either an irrational and rational approach towards a competitive task. In contrast to previous studies the findings suggest irrational beliefs did not enhance self-reported pre-performance anxiety (e.g., Rosin & Nelson, 1983) or lead to higher levels of physiological arousal (e.g., Master & Gershman, 1983) when approaching the competitive hazard perception or breath-holding task. Furthermore, an irrational or rational approach did not determine differences in the perceived helpfulness of the pre-performance anxiety. Notably however, significant differences were recorded in the believability between the self-statement groups with participants reporting irrational self-statements to be less believable compared to rational alternatives.

General Discussion

The investigation into understanding human beliefs offers important implications for research and practice aiming to enhance human functioning across various performance

contexts. In the present study we aimed to examine the effects of irrational and rational self-statements on acute performance, as well as important psychological outcomes previously associated with performance. Collectively, the findings disconfirmed the study hypotheses, challenging previous research that indicated irrational self-statements were associated with reduced task performance (e.g., Bonadies & Bass, 1984; Schill et al., 1978). In addition, the results challenge predictions of REBT theory that irrational beliefs hinder, whereas rational beliefs are helpful towards performance. There exists a plethora of research supporting the detrimental effects of irrational beliefs on psychological health (David et al., 2005; Visla et al., 2016) that have also been supported in the context of elite sport (e.g., emotional and physical exhaustion; Turner & Moore, 2015). Nonetheless, the results indicate that participants did not differ in their behavioral performance (i.e., golf-putting performance) and performance efficiency (i.e., eye gaze data) when adopting an irrational and rational approach towards a real-life competitive task. To explain, REBT theory merely posits irrational beliefs to be associated with maladaptive behaviors common in clinical settings (e.g., increased anger, self-harming, procrastination; Dryden & Branch, 2008). Further, previous research examining the effects of irrational self-statements on behavior is scant and fraught with methodological shortcomings and the precise short-term effects of irrational beliefs remained equivocal. Ultimately, evidence supporting the adverse effects of irrational beliefs on performance is meagre, thus, the notion that for some irrational beliefs may enhance performance is one that should be seriously considered.

Contrary to previous research (e.g., Rosin & Nelson, 1983) no differences were reported in pre-performance anxiety, perceived helpfulness of pre-performance anxiety, and accordingly no differences were reported in concentration disruption. Acknowledging the limitations of self-report measures (Williams & Krane, 1992), and in line with previous research (e.g., Harris, Davies, & Dryden, 2006) objective measures of physiological arousal

were used in the present study. Whilst increases in heart rate suggested participants were engaged with the competitive task, results suggest participants did not differ in physiological arousal when adopting irrational and rational self-statement conditions.

Researchers proposed irrational beliefs may harbour motivational qualities (Turner & Barker, 2014), subsequently encouraging perseverance in the face of hedonic costs in an attempt to realize long-term ambitions, certainly an important component of adaptive functioning (Williams & DeSteno, 2008). However, in-line with previous research (e.g., Rosin & Nelson, 1983) the results indicated no differences in task persistence or perceived mental effort between a rational and irrational approach to a competitive performance. Offering a nuanced view researchers have proposed irrational and rational beliefs may differ in the quality of motivation rather than the intensity. The core irrational belief of demandingness (e.g., should, must) has been compared to introjected regulation where actions are self-imposed in an attempt to avoid shame, guilt, and ego enhancement underpinned by the sense they "should" take part. Introjected regulation has been associated with expending greater effort, yet it is also related to higher anxiety, and reduced ability to cope with failure (Turner, 2016). The effects of irrational and/or rational beliefs on motivational quality may offer further insight into the precise effects on performance and warrants further investigation.

Based on the findings we suggest for some irrational beliefs may be helpful towards performance. Nevertheless, considering the prevalence of mental health disorders in performance contexts such as elite sport (Hughes & Leavey, 2012) ethically practitioners would not encourage the adoption of irrational beliefs in the pursuit of performance excellence. In addition, no evidence exists to suggest irrational beliefs offer advantages above that of rational beliefs. Ultimately, we put forth a less polarized view as to the effects of irrational and rational beliefs on performance, acknowledging that for some thinking

irrationally may be advantageous in the pursuit of short-term goals, yet detrimental for ones' psychological health in the long-term. REBT theory itself may offer an explanation into the paradoxical effects of irrational beliefs on psychological well-being and performance. Specifically, although rational beliefs are categorized as empirically true, logical, and pragmatic (i.e., helpful; Digiuseppe et al., 2013) REBT theorists have ignored the proposition that irrational beliefs can deny all logic and empirical arguments yet serve a helpful role towards goal achievement (Wilson, 2010). Furthermore, the view that irrational beliefs are wholly detrimental is challenged by the notion that human's beliefs have developed with evolutionary design in response to their environment (Pelusi, 2003). Thus, serving adaptive functions for our ancestors, where the extreme, dogmatic, and drastic responses would have ensured favourable outcomes were met. Most recently, Turner (2016) has put forth the notion of 'double-thinking' that denotes irrational and rational beliefs can exist simultaneously in a transient and stable form. Originally proposed by George Orwell (Orwell, 1949), double thinking is based on the premise that humans are able to hold two contradictory beliefs in one's mind simultaneously whilst accepting both of them. Thus an athlete maybe able to forget any fact or belief that has become inconvenient and to then only draw it back only when it is needed. For example, an endurance runner may harbour rational beliefs about adversity that ensure psychological health, yet during the final sections of a race irrational self-talk (e.g., "I must finish, otherwise it would be terrible") may facilitate goal achievement.

Limitations and Future Directions

It is important to understand the results in terms of its limitations, that if addressed could strengthen the study findings. In this study we examined the effects of irrational and rational self-statements rather than core beliefs. Further, while both self-report and objective measures of heart rate were used to confirm participant's engagement with the study manipulations the content of self-statements were not tailored to irrational and rational beliefs

pertinent to the participants. To offer a more sensitive and accurate examination future researchers may wish to tailor core beliefs relevant to the participant, as well favour the use of objective measures (i.e., pupil dilation as a measure of mental effort; G.Wood et al., 2016). The SGABS provided a reliable and validated measure of total general irrational belief scores. However, future researchers would be prudent to adopt a newly validated measure of irrational beliefs tailored for performance contexts, named the irrational Performance Beliefs Inventory (iPBI; Turner et al., 2016) to provide an accurate measure of performance specific beliefs. Rational beliefs and irrational beliefs are proposed to be dichotomous constructs, whereby low levels in one does not necessarily indicate high levels in the other (Bernard, 1998). Thus, future researchers may wish to explore the interplay between irrational and rational beliefs, and the subsequent effects on performance. Research within REBT proposes a unitary model of emotion that are quantitatively distinct (i.e., high vs. low anxiety) and a binary model of emotion that are qualitatively distinct (i.e., anxiety vs. concern; Hyland & Boduszek, 2012). To this end, future researchers are recommended to establish a validated and reliable measure of emotion sensitive to measuring both the functionality and intensity. Finally, the precise mechanisms by which irrational and rational beliefs effect performance appear to be more complicated than previously hypothesised, therefore future researchers may wish to explore role of important psychological factors (e.g., self-efficacy) that may mediate the association between beliefs and performance.

Conclusion

The findings in the present study contrast with previous research indicating that the adoption of irrational self-statements did not lead to adverse effects on performance, performance efficiency, persistence, and psychological outcomes above that of rational self-statements. To this end,3 we suggest irrational beliefs may have both positive and negative effects on performance, highlighting distinctions in both factual and practical rationality that

761 have been overlooked within the extant literature. The detrimental effects of irrational beliefs
762 for psychological health are established, accordingly understanding the precise effects and
763 mechanisms by irrational and rational beliefs effects ones ability to perform has valuable
764 implications for practitioners utilising REBT within high performance contexts.
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Figure Captions

Figure 1. Diagrammatic representation of the data collection protocols for golf-putting task (Experiment 1), hazard perception task (Experiment 2 – phase one), and breath-holding task (Experiment 2 – phase two).

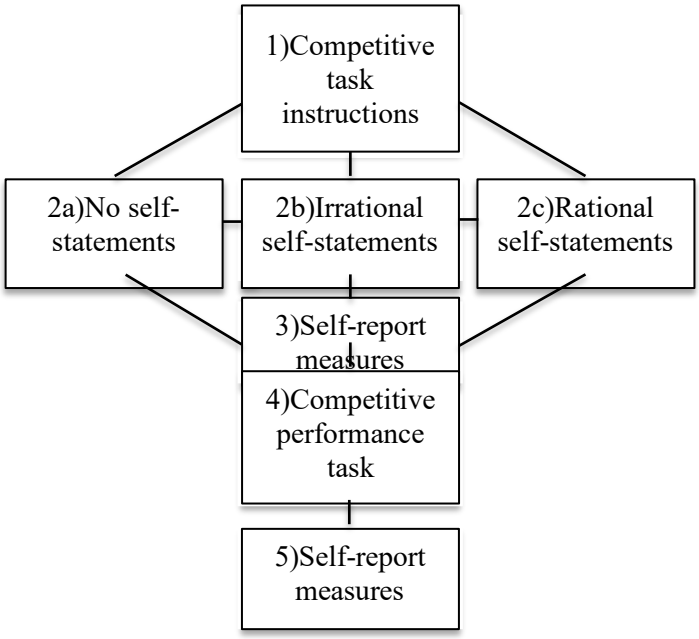

Table 1.

Mean Scores (± SD) for Outcome Measures Collected in Experiment 1 and 2.

	Baseline	Irrational Self-statement	Rational Self-statement
	Golf-Putting Task (Experiment 1)		
Golf Putting Performance	57.09 (21.03)	70.06 (17.15)	71.37 (18.39)
Pre-performance Anxiety	1.61 (.36)	1.62 (.47)	1.50 (.36)
Concentration Disruption	1.52 (.66)	1.59 (.72)	1.51(.63)
	Hazard Perception Task (Experiment 2)		
Hazard perception performance	30.03 (12.17)	26.63 (10.41)	30.40 (10.48)
Gaze data: Mean fixation duration on the hazard (ms)	10.79 (24.12)	11.15 (27.05)	19.68 (20.50)
Gaze data: Time to fixate the hazard (ms)	375.22 (299.68)	370.83 (276.89)	491.20 (369.09)
Pre-performance anxiety: Intensity	.92 (.60)	.80 (.67)	.66 (.55)
Pre-performance anxiety: Perceived helpfulness	.91 (1.22)	1.26 (1.20)	1.51 (.82)
Physiological arousal (change scores; HR)	3.06 (5.69)	2.35 (4.39)	2.61 (2.49)
	Breath Holding Task (Experiment 2)		
Task persistence (seconds)	48.22 (15.40)	52.14 (16.55)	51.67 (16.78)
Perceived mental effort	96.11 (27.89)	102.09 (28.94)	98.26 (21.46)
Pre-performance anxiety: Intensity	1.04 (.70)	.91 (.67)	.79 (.59)
Pre-performance anxiety: Perceived helpfulness	1.00 (1.55)	.74 (1.54)	1.11 (1.08)
Physiological arousal (change scores; HR)	3.96 (7.90)	4.96 (6.54)	4.53 (4.84)

Note * $p < .05$, ** $p < .001$