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International Journal of EXERCISE SCIENCE

Original Research

Regulatory Fit: Impact on Anxiety, Arousal, and Performance in College-Level Soccer Players

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ABSTRACT

International Journal of Exercise Science 13(5): 1430-1447, 2020. Sport performance may be facilitated using regulatory fit, which is a match between individuals' situational strategy and their chronic self-regulatory strategy. However, researchers have not examined the impact of regulatory fit on psychological and physiological components of sport performance, such as anxiety and arousal. Therefore, the purpose of this study was to evaluate the psychophysiological reactions to regulatory fit by examining anxiety, arousal, and sport performance. Female college-level soccer players (n = 25) were randomly assigned to the regulatory match or regulatory mismatch conditions and completed anxiety (Competitive Sport Anxiety Inventory- 2R, CSAI-2R) and underwent arousal (heart rate variability, HRV; pre-ejection period, PEP) measures pre- and post-regulatory focus manipulation. Subsequently, participants completed a sport performance task (10 penalty kicks). The impact of regulatory fit on the dependent variables was explored through repeated measures ANOVAs. Results revealed a significant time effect for cognitive anxiety and self-confidence subscales of the CSAI-2R, suggesting the penalty kicking task increased cognitive anxiety and reduced self-confidence in all participants. In addition, there was a significant interaction effect of condition on pre-ejection period (PEP), with a greater increase in PEP for those experiencing regulatory fit compared to those who were not. There were non-significant interaction and main effects for all other variables. Since PEP is an inverse measure of sympathetic (SNS) modulation, experiencing regulatory fit may reduce SNS involvement in the heartbeat. Thus, the current results indicate experiencing regulatory fit may influence arousal prior to athletic competition.

KEY WORDS: Regulatory focus, sport performance, HRV, PEP

INTRODUCTION

Higgins (21) proposed that humans view their goals, or regulate their behavior, through promotion or prevention regulatory foci. In other words, individuals frame their goals, use strategies, and experience emotions aligned with these two types of regulatory foci. While promotion-focused individuals base their goals off a desire to win, advance in life, and strive for an 'ideal self', those who are prevention-focused set goals based off personal 'oughts' and remaining safe. Thus, promotion focus orients individuals towards achieving positive end-states and prevention focus is an orientation towards avoiding negative outcomes. These foci can be trait-like or state-like (21, 22, 40). Trait-like focus indicates chronic orientation towards one regulatory focus and state-like focus reflects orientation towards a focus in a single situation. When individuals' chronic regulatory focus matches their situational regulatory focus, they experience regulatory fit (22), possibly leading to "feeling right" (23), increased motivational intensity, and improved performance.

In the cognitive and heath domains, previous research demonstrated individuals experiencing regulatory fit perform better than individuals who were not experiencing regulatory fit (2, 26, 46). In one study, undergraduate students who experienced regulatory fit were 50% more likely to turn in an essay than those who were not experiencing regulatory fit (53). Similar effects were found within a team setting where regulatory fit led to higher work performance compared with teams who did not experience regulatory fit (2, 16). Additionally, when health goals were framed to match inactive adults' chronic regulatory focus, their physical activity increased when compared to those whose goal-framing did not match their chronic regulatory focus (31). Along the same lines, undergraduate students reported higher motivation and intention towards physical activity (53) and higher intention to eat more fruits and vegetables (9) while experiencing regulatory fit compared to when they experienced a mismatch between their chronic regulatory focus and their situational regulatory focus. These results were corroborated in a sample of adults who read promotional physical activity messages which matched or did not match their chronic regulatory focus (15). Recent work demonstrated that level of experience may influence the performance response to regulatory fit, where regulatory fit appeared to have no effect on experienced exercisers while inexperienced exercisers endured exercise longer while experiencing regulatory fit compared to those who did not experience regulatory fit (26). Overall, it appears that regulatory fit may enhance motivation, intentions towards, and participation in healthy behaviors.

Previous research indicated similar findings in sport settings; regulatory fit enhanced both penalty kicking and golf putting in elite athletes (29, 33, 46). Specifically, Plessner and colleagues (46) explored the impact of regulatory fit on a soccer penalty kick task taken by 20 semi-professional soccer players on the same team. Participants completed a questionnaire to measure their chronic regulatory focus and were randomly assigned to either receive goals based on achieving positive outcomes (i.e., promotion focus) or goals based on avoiding negative outcomes (i.e., prevention focus), thus inducing a situational regulatory focus which either matched or mismatched their chronic regulatory focus. The results indicated participants in the promotion condition with a chronic promotion focus performed better than those who had a chronic prevention focus. The same phenomenon was demonstrated in the prevention condition where those with a chronic prevention focus performed better than those with chronic promotion focus. Thus, demonstrating the benefits of regulatory fit on sport performance. Similar results were demonstrated with elite golfers; performance was best when chronic regulatory focus and situational regulatory focus matched (29). In fact, participants who experienced regulatory fit performed approximately 20% better in the golf putting task than those who did not experience regulatory fit. These results indicated that matching participants' situational regulatory focus with their chronic regulatory focus to obtain regulatory fit can enhance sport performance.

Anxiety and arousal are also important to consider in the context of sport performance. Anxiety is a psychological construct that pertains to the negative perception of physiological activation (51). The activation that individuals feel throughout the day stems from autonomic nervous system (ANS) activity that ranges from a comatose state (no arousal) to extreme activation (high arousal; 34). The parasympathetic nervous system (PNS), a division of the ANS, promotes normal functioning and helps the body conserve energy while the body is at rest (35). On the other hand, the sympathetic nervous system (SNS), the second branch of the ANS, is activated under conditions of stress and prepares the body for "fight-or-flight." These systems work in synergy to regulate important physiological processes, such as changes in heart rate (HR), where the PNS system predominates during rest and the SNS takes over under stressful conditions. The balance between these two systems can be determined through heart rate variability (HRV). HRV is the variation in the time of successive R-R intervals, which can be used as an indication of PNS modulation (4, 8). Specifically, different components of HRV (e.g., high frequency, HF; and square root of the mean squared differences of successive NN intervals, RMSSD) indicate increased activation of the PNS (4, 8). Moreover, greater overall HRV, as measured by HF or RMSSD, indicate an adaptive response to stress and better cognitive performance due to its integration with the prefrontal cortex (54). On the other hand, SNS activation can be measured by pre-ejection period (PEP), a measure of how long it takes for the left ventricle of the heart to fill, which is shortened while the body is under stress (3, 5). Much of the literature on anxiety and arousal utilizes psychological questionnaires and physiological measures of HRV.

In a recent study, researchers examined the impact of regulatory fit on psychological (i.e., anxiety) and physiological (i.e., HRV) variables using different levels of stressful work environments (44). Participants completed three task conditions as if they were a store manager with the aim to provide comprehensive and competent e-mail responses. The conditions included 1) a neutral task where participants were not given instruction, 2) a task that allowed participants to follow guidelines to complete the task using any strategy they choose (i.e., promotion task), and 3) a task where they followed a strict policy provided to them (i.e., prevention task). Throughout each task, arousal variables, such as heart rate, HRV, and performance (i.e., number of words typed, number of emails completed) were recorded. Tension-Anxiety, using the Profile of Mood States, was assessed at baseline and after each condition. Results indicated high chronic promotion focus was associated with more words typed in the promotion task compared to the neutral task whereas high chronic prevention focus was associated with more emails completed and increased HRV in the prevention task compared to the neutral task. Subsequently, it appeared that regulatory fit, or a match between chronic regulatory focus and situational regulatory focus, was associated with improved performance and increased HRV activity. To date, no published studies examined these variables in the sport context. However, the influence of anxiety and arousal has received much attention in the wider literature.

Researchers who assessed the effect of anxiety on sport performance report equivocal relationships (1, 12, 25). For example, performance during a reaction time test was enhanced with higher amounts of arousal until a certain point, at which further arousal was debilitating to performance (1). Further, in a study with expert golfers, the researchers found reported anxiety correlated with greater SNS and decreased PNS activation during pressured golf performance (12). In a separate study, Cooke, Kavussanu, McIntyre, and Ring (13) found similar results in an endurance handgrip task. While participants were competing, those who experienced low amounts of anxiety gripped the dynamometer longer than those who experienced higher amounts of anxiety. This performance pattern (increased SNS and decreased PNS) also emerged in soccer penalty kick studies, especially when the importance of performance outcome increased (17, 36). In contrast, a sample of elite rock climbers indicated higher anxiety was more predictive of high performance than lower anxiety prior to an elite climbing competition (51).

Furthermore, recent research indicated a significant negative association between anxiety and HRV (19), indicating an inverse relationship between anxiety and HRV. Increasing levels of HRV indicate that the body is reacting to the stressor in an efficient manner, thus, anxiety may be debilitative to performance if accompanied by reduced HRV. Further equivocal relationships were demonstrated in examinations which included physiological variables such as heart rate (HR; 11), HRV (13), and PEP (38). For example, Blásquez and associates (7) found that in a group of swimmers PNS activity (i.e., RMSSD) decreased prior to a competition. Other studies demonstrated increased PNS activity (11) and yet others note either no change or decreased PNS activity (13, 37) in response to competition. Although not measured in sport, in a sample of students completing oral exams, researchers found greater SNS activation (i.e., reduced PEP) following their performance compared to their baseline SNS level (49). Thus, it appears results on SNS and PNS activity during competition is varied. Previous research may indicate that these reactions are modulated by psychological stress (19), however this claim has not been specifically tested.

Perhaps the biopsychosocial model of challenge and threat theory (BPS; 5) may be of utility in understanding the stress response to competition. The BPS model postulates individuals can gauge their sport performance as a *challenge* or *threat* based on their appraisal of personal resources and situational demands. If personal resources (knowledge and abilities, personality characteristics, support) exceed task demands (danger, uncertainty, effort), then a challenge state ensues. If the opposite is true, a threat state ensues. During a challenge state, the autonomic response includes increased SNS, cardiac output, and decreased vascular resistance, which are considered beneficial responses. During a threat state, SNS activity and cardiac output increases to a lesser magnitude than in a challenge state, and there is no change in vascular resistance, thus the physiological response to threat may hinder performance. In fact, previous research examined this model using athletic performance and found challenge and threat indices to be predictive of sport performance where challenge elicited better performance than threat (6, 55). Keeping this in mind, it is possible that the "feeling right" that develops from regulatory fit intersects with the *challenge* state described by BPS (5), thus increasing performance and eliciting adaptive physiological responses. Evidence for the ability of regulatory fit to alter physiological states lies in Parker and colleagues' (44) study, which indicated participants who experienced regulatory fit had better performance and increased HRV compared to when they did not experience regulatory fit in occupational tasks. Thus, the same may be true in the context of sport performance, but such responses have not been determined.

If this were true, inducing regulatory fit may be a useful strategy to overcome debilitative anxiety or arousal reactions to competition. However, the first step is to determine the psychological and physiological response to regulatory fit in sport. Therefore, we examined the impact of regulatory fit on sport-related anxiety and arousal, as measured by HR, HRV, and PEP, pre to post task framing and on subsequent sport performance. We hypothesized that participants experiencing regulatory fit would report less anxiety and perform better than those not experiencing regulatory fit.

METHODS

Participants

A total of 26 female soccer players from a midsize Division I Midwestern university volunteered for this study; one was excluded for meeting exclusion criteria thus 25 participated in this study. Volunteers were recruited from the university team and general student body who had at least five years of competitive soccer experience and were competitive within the last 18 months. Participants were excluded if they had any injury or health condition that could have been worsened by kicking penalty kicks or were taking medications which influence their heartbeat. Participants' mean age was 19.40 (SD = 1.50). Of the 25 participants, 24 were White and 1 was African American. Participants weighed an average of 63.70 kg (SD = 12.75) and were an average of 165.71 cm (SD = 6.19) tall. They had an average of 11.06 years (SD = 3.27) of competitive soccer experience with an average of 5.00 months (SD = 5.63) since their last competition. Due to technical malfunctions and incomplete questionnaires, not all 25 participants' data were available for every variable; 25 participants were included in analyses involving performance, 23 participants in analyses involving somatic anxiety, 24 participants in analyses involving cognitive anxiety and self-confidence, and 22 participants in analyses involving physiological measures.

Protocol

This research was carried out fully in accordance to the ethical standards of the International Journal of Exercise Science (43). We obtained IRB approval for this study and recruited participants through campus wide emails as well as from a collegiate women's soccer team. Participants received no direct compensation for their participation. All participants gave their written informed consent prior to participating in the study. Prior to starting the experimental protocol, participants provided written informed consent and completed the demographic form and *Regulatory Focus Questionnaire* (RFQ; 32). The demographic form requested information such as age, sex, ethnicity, height, weight, and number years of overall competitive soccer experience. The RFQ was used to determine the chronic regulatory focus of each participant. It is comprised of two 9-item subscales (i.e., promotion and prevention) evaluated on a 9-point Likert-type scale from 1 "not at all true to me" to 9 "very true to me." Following previous research using this survey with an athlete population (46), 4 items were modified to fit the sportive context by changing the phrase "academic goals" to "athletic goals." Scores ranged from -9 to 9 and were calculated by computing a difference score from the averages of each subscale (i.e., promotion and prevention) (27, 46). Positive numbers indicate chronic promotion focus and negative numbers indicate chronic prevention focus. In our sample, both subscales were found to be reliable (promotion α = .81; prevention α = .82). Those recruited from the soccer team (n = 12) completed the informed consent form, demographic information, and the RFQ on paper and those recruited from the campus wide email (n = 14) filled out the same surveys online.

Participants completed physiological assessments in the laboratory prior to completing the sport performance task in an indoor turf field. Upon arrival at the assigned room, participants were fitted with the a Biopac MP35 system (Biopac Systems, Inc., Goleta, California) in preparation for baseline physiological assessments (i.e., *arousal* measurements). Specifically, in a separate private room, the research assistant outfitted the athlete with five electrodes for a single-lead electrocardiogram (ECG) and impedance cardiography (ICG) recording. Next, the participant sat in a provided chair located near the Biopac transducer and took a breath in as deeply as possible and exhaled completely as a band was tightened around their chest for a respiratory transducer which recorded respiratory rate. Data were collected continuously at a frequency of 1000 Hz. Respiratory rate was held constant at 15 breaths/minute (0.25 Hz) using a standard metronome and measured using a respiration transducer model TSD201 (Biopac Systems, Inc., Goleta, California) because respiration can have an impact on HRV (8, 30). Researchers visually confirmed compliance with this instruction. ICG was conducted using a cardiac impedance amplifier in channels one and two using two paired foam electrodes placed on the posterior side one inch above the C7 prominence of the neck, and on the posterior side in the middle of the back in line with the superior aspect of the scapula. Win CPRS software was used to automatically identify all R-waves to determine R-R intervals. The ECG also was manually inspected to ensure proper identification and inclusion of all R-waves. Ectopic heart beats were identified and corrected using the interpolation method (32). The R-R interval data series was analyzed by the WinCPRS software to calculate *RMSSD*. In addition, the data series was transformed using the fast Fourier transformation to determine the power spectrum of HRV. *HF* was the area under the curve between 0.15 and 0.4 Hz. RMSSD and HF have both been shown to be primarily mediated by PNS activity (4, 8). The ICG provided us with a dZ/dt wave, which was used to identify the B-point and used in conjunction with the Q-wave from the ECG wave to identify the *PEP*. Heart rate, HF, PEP, and RMSSD were used to quantify the level of *arousal* the participants experienced during the experiment. Following recommended HRV measurement guidelines (8, 30), physiological data was continuously recorded during three five-minute phases: acclimation, baseline, and post-manipulation. The acclimation phase was included to ensure we had accurate tonic activity during the baseline phase, thus only baseline and post-manipulation recordings were used in subsequent analyses (see below). We recorded the times at which the acclimation and resting periods began and ended.

During the acclimation phase, the participant sat comfortably and quietly while she completed the *Competitive Sport Anxiety Inventory-2R* (CSAI-2R; 14). The CSAI-2R included three subscales, somatic anxiety, cognitive anxiety, and self-confidence, with a total of 17 items rated on a 4-point scale and 1 indicating “not at all” and 4 indicating “very much so.” Scores were calculated by summing items from each subscale with scores ranging from 0-28 for the somatic subscale and 0-20 for the cognitive anxiety and self-confidence subscales. In the current study, the survey was found to have Cronbach’s alphas of .76, .68, and .83 for the somatic, cognitive, and self-confidence subscales respectively.

After this, the participant remained seated and still while the measurements were recorded for the 5-minute baseline phase. At the same time, the research assistants determined the participant's chronic regulatory focus (by scoring the RFQ as described above) and randomly assigned the participant into one of two groups: regulatory match or regulatory mismatch. Individuals in the regulatory match group received the same type of task framing as their chronic regulatory focus, thus inducing regulatory fit. Participants assigned to the regulatory mismatch condition received the task framing opposite of their chronic regulatory focus, thus did not experience regulatory fit. Of the participants in the regulatory match group, 11 participants heard the promotion task framing and one participant heard the prevention task framing. Of the participants in the regulatory mismatch group, one participant heard the promotion task framing and 12 participants heard the prevention task framing. The task framing statements were modeled after previous research (29, 46) and were worded as follows:

Promotion statement: "You are going to take ten penalty shots. Your aspiration is to score at least eight times."

Prevention statement: "You are going to take ten penalty shots. Your obligation is not to miss more than two times."

Once the baseline period was over, we explained the sport performance task protocol using their assigned task-framing phrase. In addition, we gave the participant a printed copy and instructed them to keep their phrase with them for the duration of the experiment. The participant was instructed to imagine the task protocol while she sat for an additional five minutes for the post-manipulation arousal measures. The task-framing phrase remained with the participant for the remainder of the experiment. Once the participant heard the task protocol, one of the research assistants left the room and set up for the task protocol.

Upon completion of physiological measurements, we led the participant to an indoor turf field (approximately 5 minutes), where the performance task protocol took place. The protocol consisted of taking 10 penalty kicks and the number of successful penalty kicks out of 10 served as the measure of *performance* in this study. Previous similar research required participants to take five penalty kicks in the presence of an experienced goalie (46). We did not use a goalie in this study and, after consulting with professionals, we increased the number of penalty kicks to 10. In addition, we added a directive to aim for a specific corner ("high left," "high right," "low left," or "low right"). This was deemed necessary after pilot testing revealed the task as too easy (i.e., the individual made 10 shots), thus there would not be enough variability in our outcomes to be able to detect an effect. All participants were asked to kick 10 penalty kicks in an indoor turf field into a large soccer goal (6.5 ft X 12 ft X 6.5 ft). Participants took each penalty kick from the penalty mark located 12 yards from the center of the goal as is standard for National Collegiate Athletic Association play (42). For the kick to be considered a success, the shot had to be between the goal post and a cone set three feet inside the goal as well as in a specified corner. Upon arrival at the turf field, the participant completed the CSAI-2R and warmed up for 5 minutes using their usual penalty kick warm up routine, then she took 10 penalty shots, with 30 seconds rest between each shot. The participant drew a piece of paper from a hat prior to each kick, which detailed the direction the participant needed to kick. Participants read their task-framing phrase between each kick to ensure participants remained in the desired group. In addition, they retrieved their own balls. We recorded the success and the direction of the shot after each attempt. Upon completion of this protocol, the participant filled out a one-item manipulation check to determine motivation toward performing the task to the best of their ability. The item stated: "I put forth my best effort" and was rated on a 5-point Likert type scale, ranging from 1 "strongly disagree" to 5 "strongly agree." Participants in the match group reported a mean of 4.17 (SD=.835) and participants in the mismatch group reported a mean of 3.92 (SD=1.038), suggesting participants "agreed" they gave their best effort to succeed in the penalty kicking task. In addition, we answered any questions the participants had before leaving. Each participant completed the study protocol individually, which took approximately 60 minutes. See Figure 1 for a basic flowchart of measurements.

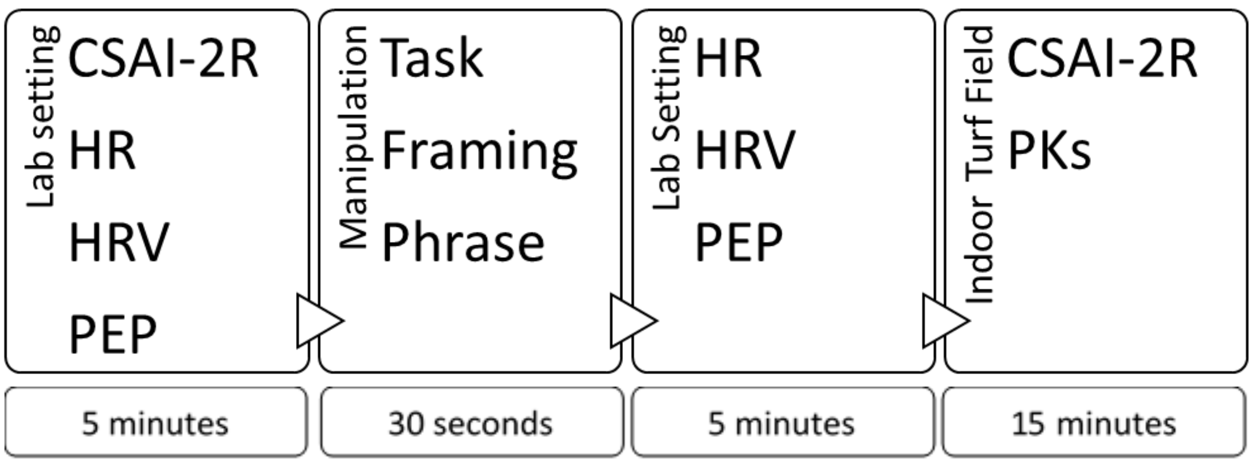

Figure 1. Flowchart of variables measured. This figure illustrates the setting and order that each variable was measured in this study.

Statistical Analysis

The basic design of this study was an experimental pre-post with seven dependent variables assessed during pre- and post-measurement (CSAI-2R somatic, CSAI-2R cognitive, CSAI-2R self-confidence, HR, HF, RMSSD, and PEP) and one dependent variable (performance) assessed only during post measurement. Statistical analyses were ran using SPSS version 25 (IBM, Inc., Chicago, IL). Independent t-tests were utilized to compare the demographic makeup of each condition. Psychological anxiety was measured by CSAI-2R, and performance was determined by number of successful penalty kicks out of 10.

To answer the research question, several ANOVAs were run, the first being a one-way analysis of variance (ANOVA) with condition group as the independent variable, and performance as the dependent variable to test the effect of regulatory fit on performance. Next, repeated measures (RM) ANOVAs were run to test the pre-post effect of regulatory fit on anxiety and arousal measures. Significant interaction effects were followed up by planned contrasts to determine pre-post changes by group. In addition, two-tailed Pearson correlations were run to understand if there were any significant linear relationships between number of successful penalty kicks and anxiety and arousal outcomes. We conducted correlations between penalty kicks and anxiety and arousal outcomes taken post-manipulation as we were interested in understanding our outcomes in context of regulatory fit. All assumptions were checked prior to running analyses and the significance level was set to α = .05.

As an exploratory measure, Cohen's *d* effect sizes were calculated to understand the magnitude of difference in means from pre to post manipulation (10). Cohen's *d* was calculated using the following formula: $(M_{post\text{-}manipulation}-M_{baseline})/SD_{pooled}$ and cutoffs were defined as small (*d*=.25), medium (*d*=.5), or large (*d*=.9) (10, 47).

RESULTS

There were no significant differences in demographic variables between the regulatory match and regulatory mismatch groups (see Table 1); thus, indicating the groups were similar in make-up (e.g., age, height, weight) and could be compared on the dependent variables.

Table 1. Descriptives using t-test for equality of means.

	Match			Mismatch				
	M	SD	N	M	SD	N	(t)	*df*
Age (yrs)	19.50	1.00	12	19.31	1.89	13	.31	23
Height (cm)	165.31	6.54	12	166.08	6.09	13	-.30	23
Weight (kg)	65.11	17.78	12	62.39	5.61	13	.53	23
Promotion Subscale	6.88	1.21	12	7.53	0.69	13	-1.67	23
Prevention Subscale	4.09	1.12	12	1.42	4.78	13	-2.57*	23
Chronic Regulatory Focus	2.79	1.84	12	2.11	1.63	13	.97	23
Years of experience	10.71	3.43	12	11.39	3.23	13	-.51	23
Months since last competition	5.50	5.76	12	4.54	5.71	13	.42	23

Note. M= Mean; SD = Standard Deviation * $p < .05$

Table 2. Means by condition group.

	Match						Mismatch					
	Pre			Post			Pre			Post		
	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Penalty kicks				3.00	0.28	12				2.54	1.76	13
CSAI-2R Somatic	14.29	3.94	11	15.45	3.93	11	15.83	3.92	12	16.67	5.32	12
CSAI-2R Cognitive	17.00	5.82	12	20.17	8.76	12	19.50	5.73	12	23.17	6.63	12
CSAI-2R Self-confidence	28.33	5.03	12	26.83	5.62	12	27.33	6.80	12	23.50	4.60	12
Heart rate (bpm)	76.38	4.14	11	75.15	4.36	11	75.26	4.14	11	74.62	4.36	11
HF (ms^2)	758.55	778.80	11	874.45	1130.63	11	1171.09	1217.05	11	1267.55	1042.72	11
ln HF	6.19	0.30	11	6.30	0.29	11	6.64	0.30	11	6.86	0.28	11
RMSSD (ms)	43.36	25.39	11	43.64	27.29	11	52.18	28.31	11	58.36	24.66	11
ln RMSSD	3.63	0.16	11	3.64	0.14	11	3.84	0.16	11	4.00	0.14	11
PEP (ms)	132	11	11	140	11	11	147	18	11	148	18	11

Means and standard deviations can be found in Table 2. When sphericity was violated, Greenhouse-Geisser statistics were interpreted (ANOVA for regulatory fit and performance and all RM ANOVAs). When normality was violated, natural log (ln) transformations were utilized to satisfy this assumption. Results of the ANOVA for regulatory fit and performance were non-significant for the effect of condition (Match; Mismatch) on the performance variable of number of successful penalty kicks, $F(1, 24) = .65$, $p = .43$, $\eta^2 = .03$. Results from the RM ANOVAs for regulatory fit and anxiety subscales were non-significant for the interaction between pre to post effect and condition (Match; Mismatch) on the somatic, cognitive, and self-confidence subscales of the CSAI-2R (see Table 3). There was a significant main effect of time for the cognitive subscale with results indicating an increase in cognitive anxiety from pre- (M=18.25, SD= 5.79) to post- (M=21.67, SD= 7.75) manipulation in the whole sample (d=0.50). Similarly, there was a significant main effect of time for self-confidence subscale with results indicating a decrease from pre- (M=27.83, SD=5.81) to post- (M=25.17, SD=5.31) manipulation (d=-0.48). There were no significant main effects for condition for any subscale. Results of the RM ANOVAs for regulatory fit and the physiological variables HR, ln HF, and ln RMSSD revealed non-significant interactions between the pre to post effect and condition (see Table 3). Similarly, no significant main effects were found for these variables. However, there was a significant interaction effect between pre to post manipulation and condition for PEP (see Table 3), indicating those experiencing regulatory fit had a greater increase in PEP compared to those who did not experience regulatory fit. Planned contrasts were used to examine the pre- to post- changes in PEP by condition. The results revealed no significant differences pre- to post- manipulation in the regulatory match condition and no significant difference pre- to post-manipulation in the regulatory mismatch condition (see Figure 2). Pearson correlation analyses revealed non-significant linear relationships between penalty kicks, CSAI-2R subscales, and arousal measures (see Table 4). Cohen's d calculations indicate small-to-moderate increases in somatic and cognitive anxiety, small-to-moderate decreases in self-confidence, small reductions in heart rate, small-to-large increases in ln HF and RMSSD, and small-to-moderate increases in PEP (see Figure 3).

Table 3. ANOVA results table.

	Interaction Effects				Main Effects Time				Main Effects Condition			
	Df	F*	η^2	*p*	*Df*	F*	η^2	*p*	*Df*	F*	η^2	*p*
CSAI-2R Somatic	1,21	.03	.00	.86	1,21	1.08	.05	.31	1,21	.81	.04	.38
CSAI-2R Cognitive	1,22	.05	.00	.83	1,22	9.03	.29	.007**	1,22	1.16	.92	.29
CSAI-2R Self-confidence	1,22	1.93	.08	.18	1,22	10.08	.31	.004**	1,22	1.07	.05	.31
HR (bpm)	1,20	.03	.00	.86	1,20	0.30	.02	.59	1,20	.02	.00	.89
ln HF	1,20	.29	.01	.59	1,20	2.45	.11	.13	1,20	1.66	.08	.21
ln RMSSD	1,20	3.29	.25	.09	1,20	3.64	.33	.07	1,20	1.98	.16	.18
PEP (ms)	1,20	6.74	.14	.02**	1,20	9.66	.15	.01**	1,20	3.68	.09	.07

* Greenhouse-Geisser values
** $p < .05$

Table 4. Correlation coefficient values (Pearson) between number of successful penalty kicks and anxiety and arousal measures taken post-manipulation.

	Post CSAI-2R Somatic	Post CSAI-2R Cognitive	Post CSAI-2R Self-confidence	Post HR	Post ln HF	Post ln RMSSD	Post PEP
Penalty Kicks	.000	.006	.021	.149	-.182	-.130	-.271

* $p < .05$

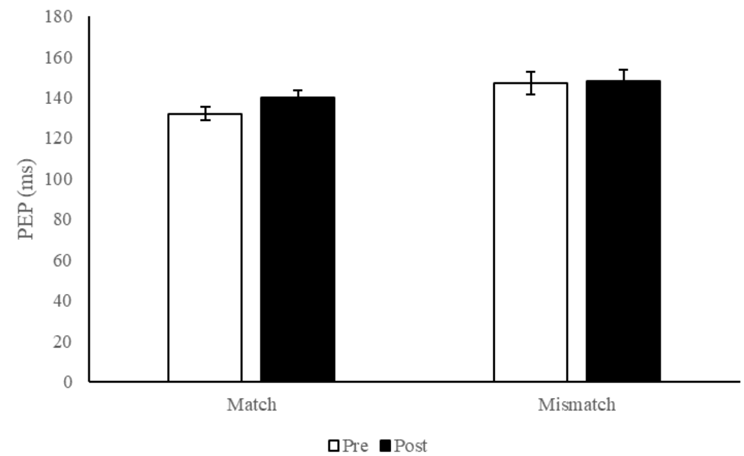

Figure 2. Condition effect on PEP over time. * $p < .05$

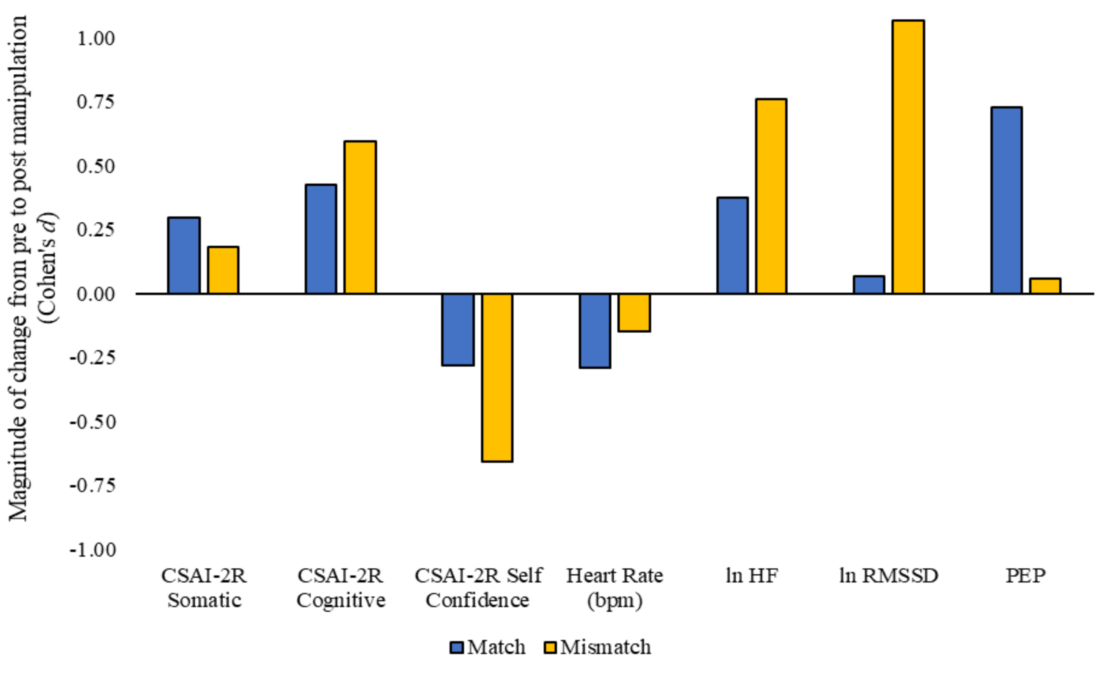

Figure 3. Magnitude of effect (Cohen's *d*) for changes in psychological and physiological outcomes from baseline to post-manipulation.

DISCUSSION

Per regulatory focus theory (21), when individuals' goal pursuit strategies match their goal framing, they are likely to perform better than if there is a mismatch between the two (22). The results of the current study did not support this predicted finding for performance during a penalty-kicking task with college-level soccer players. However, upon examination of psychological and physiological indicators of anxiety and arousal, we found a significant increase in cognitive anxiety and significant decrease in self-confidence from baseline to post-manipulation, suggesting that imagining the penalty kick task induced anxiety in the participants. In addition, there was a significant effect of regulatory fit on PEP, a measure of sympathetic modulation of the cardiovascular system, but these results did not expand to HF and RMSSD, measures of PNS activity. Thus, regulatory fit may have some utility in influencing arousal prior to performance but may have little impact on performance of this type of task.

Contrary to previous research, our results do not indicate an effect of regulatory fit on sport performance. This challenges previous studies that indicated a performance effect in other athletic tasks in familiar or simple tasks (29, 46). The current penalty-kicking task included several more instructions than typical penalty kick practice; thus, it may have required more attention than a typical penalty kick. As athletes advance in skill, the physical demands of their sport become automatic processes (28) leaving more of the athletes' attention for other important performance skills, such as game strategy or mental preparation. Further, previous research points to the deleterious effects divided attention has on performance outcome due to an increase in anxiety (18). If the present task required divided attention to complete it is possible that the demand was too high for regulatory fit to impact their performance.

Along similar lines, previous research indicated penalty kicks to be a prevention task since they are a prescribed requirement of the game rather than a chance to be creative such as during regular game play (46). Additionally, soccer players may experience high social pressure when taking penalty kicks, thus creating situational prevention focus in players throughout the task (57). The nature of some tasks requires more creative strategies to be successful, such as brainstorming for a project, and others require detail and vigilance, such as cleaning (56). Plessner and his associates' (46) conclusions support the idea that penalty kicks may be a prevention task due to their finding that regulatory fit enhanced performance more in participants with chronic prevention focus than in those with chromic promotion focus. In the present study, all but one person was chronically promotion focused, and it is possible that the prevention nature of the PK task interacted with their chronic regulatory focus more than their assigned task-framing phrase. This is an important consideration in light of Parker and associates (44) work, who found, for those with prevention focus, the effect of regulatory fit on performance and PNS activity increased with stronger prevention focus.

While there were no significant performance differences, our results indicate that cognitive anxiety significantly increased and self-confidence significantly decreased from baseline to post-manipulation for all participants. These results suggest that imagining the penalty kick task induced anxiety in the participants, as measurements were taken at baseline and immediately prior to the performance task (i.e., post-manipulation). Thus, it makes sense that participants reported higher anxiety from baseline to post-manipulation. Previous research examining pre-performance anxiety is equivocal. Our results contradict some research which indicated anxiety did not differ between non-competitive and competitive states (17, 24). One the other hand, our results may support some research which demonstrated anxiety is higher before a competition compared to before practice (48, 52). However, Souza and associates (52) found somatic anxiety was higher pre-competition compared to pre-training while cognitive anxiety and self-confidence did not differ. In the current study, we hypothesized participants experiencing regulatory fit would report less anxiety than those who did not experience regulatory fit, which was not supported by our results. However, when examining the Cohen's *d* effect sizes, there are some interesting implications. Those in the match group had a small increase in cognitive anxiety and a small decrease in self-confidence, whereas those in the mismatch group had a medium increase in cognitive anxiety and a medium reduction in self-confidence (see Figure 3). This may suggest that those who experience regulatory fit had smaller increases in cognitive anxiety and smaller reductions in self-confidence than individuals who experienced a mismatch. However, future research with larger sample sizes is needed before this conclusion can be drawn.

Parasympathetic and SNS are stimulated due to many reasons, one being mental stress, with PNS activity decreasing and SNS activity increasing as anxiety increases. Although there were no changes in PNS indices (RMSSD or HF), the current study found regulatory fit differentially impacted SNS involvement (PEP); specifically, participants experiencing regulatory fit experienced a greater decrease in SNS involvement in the heart beat compared with those who were not experiencing regulatory fit. Subsequent planned contrasts designed to determine the SNS response by group revealed no significant differences in either group. Thus, it appears that those who experienced regulatory fit compared with those who did not experience regulatory fit had significantly different SNS involvement in cardiac regulation. However, when comparing the SNS response within each group, there were no significant differences; thus, future research is necessary to elucidate individual responses to experiencing regulatory fit. Previous research examining PNS involvement prior to or during performance is equivocal (7, 12, 20, 39). However, these studies did not consider differential mental states, such as self-regulatory focus (22). Some researchers examined distinct SNS involvement in performance depending on the mental states of challenge and threat and found these responses may predict performance (6, 54). It is possible that, like the biopsychosocial model of challenge and threat model, experiencing regulatory fit or not elicits differential PNS and SNS responses prior to performance. While few researchers include a measure of SNS, Parker and colleagues (44) demonstrated PNS activation when participants experienced regulatory fit, which was not replicated in our study. Further, our results indicate weak effect sizes, thus it is evident that more research is needed to understand the ANS involvement in sport performance while experiencing regulatory fit.

Although previous research documented changes in ANS function as a response to sport performance (7, 38, 41), our manipulation was like Parker and colleagues' (44) because we measured physiological variables only during the task-framing portion. Specifically, we measured ANS involvement in a lab setting prior to asking participants to take their penalty kicks on a turf field. We found differential SNS responses to the manipulation between our conditions, indicating there may have been psychophysiological changes occurring in those individuals. The physiological measures may have been a more sensitive measure than either anxiety or performance due to the laboratory setting. Since the difficulty of penalty kick tasks may increase when it becomes more important (17, 25), it is possible our study task was not salient enough to elicit changes in anxiety or performance. In line with this thought, the participants in this study reported lower anxiety than similar studies assessing psychological anxiety during sporting events (17, 41, 49). However, this may be due to the reported stronger promotion focus than in previous research (29, 46), which may account for the low reports of anxiety due to a negative correlation between anxiety and promotion focus (20). Perhaps examining the relationships between regulatory fit, anxiety, and sport performance during real-time would help shed light on the utility of regulatory fit in sport performance.

There are some limitations to the current research that should be considered. First, the sample size for this study may be insufficiently powered to detect significant effects for performance, anxiety, or HRV variables, thus future studies following this line of research should include larger samples. Future researchers should also consider potential variations in different types of regulatory fit (i.e., promotion-promotion; prevention-prevention) and regulatory mismatch (i.e., promotion-prevention; prevention-promotion). This could be done by inducing both a global regulatory focus (i.e., similar to chronic regulatory focus in this study) and a situational regulatory focus (i.e., similar to the task framing phrase in this study). This consideration is especially important for future researchers to consider in light of the current study in which participants in our regulatory mismatch condition had significantly higher scores on the prevention subscale of the chronic regulatory focus questionnaire compared to the regulatory match group, indicating those in the mismatch condition had stronger prevention focus. In addition, it is possible that the task-framing phrase failed to alter the participants' chronic regulatory focus despite using a previously validated manipulation protocol (e.g., 15, 16, 29, 46). Perhaps forcing participants to aim for a specific corner created a prevention task (versus free choice which may be considered a promotion task), which could have overridden their task framing phrase. However, participants were asked to read their task framing phrase between every kick, thus were reminded of their situational regulatory focus consistently. In addition, we cannot rule out the potential influence of time of day on our HRV measurements as we did not record this information. Further, there were relatively low reports of anxiety before the penalty kick task; thus, a floor effect may explain a lack of difference in anxiety intensity. It may be more beneficial to measure anxiety during the sport task, perhaps using a one-item Likert scale, which has been used in previous protocols may be useful. Further, future research should expand these results to examine the psychophysiological responses to regulatory fit throughout the sport tasks to inform the utility of using regulatory fit to influence anxiety, arousal, and sport performance.

The current study adds to the literature on the impact of regulatory fit on anxiety, arousal, and performance in sport in several ways, as it appears to be the first study to examine the effects of regulatory fit on anxiety and arousal in sport. According to the current results, regulatory fit elicited a greater decrease in SNS modulation compared to the SNS response in those who were not experiencing regulatory fit but had no impact on other measures of anxiety or performance in our sample. Perhaps regulatory fit may be used to elicit facilitative arousal responses to athletic competition, however further research is needed to be able to design specific interventions. Further, it is possible the psychophysiological reactions may serve as the mechanism behind the performance enhancing effect of regulatory fit, however this cannot be determined through the current results. Future research may benefit from the use of qualitative methods to gain an understanding of the degree in which athletes use regulatory fit language. In addition, brief measures of anxiety may provide a useful strategy to be more sensitive to changes in anxiety throughout performance. Previous research suggested performance decreases when an athlete's attention is overloaded (18), which may have been the case in the present study. If this is true, regulatory fit may be a useful strategy to enhance performance when athletes are performing automatic or well-learned tasks. We recommend further research in this subject matter to support the present results and conclusions.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the Aspire Program at Ball State University for funding this project. In addition, the authors would like to thank Andy Walsh and Nile Brandt for their enthusiasm and attention to detail as they assisted with data collection.

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