

Emotions and Sport Performance: An Exploration of Happiness, Hope, and Anger

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We conducted three experiments to examine the relationships between emotions and subcomponents of performance. Experiment 1 revealed that anger was associated with enhanced gross muscular peak force performance but that happiness did not influence grammatical reasoning performance. Following Lazarus (1991, 2000a), we examined hope rather than happiness in Experiment 2. As hypothesized, hope yielded faster soccer-related reaction times in soccer players. Experiment 3 was an examination of extraversion as a moderator of the anger-performance relationship. When angry, extraverts' peak force increased more than introverts'. Results are discussed and future research directions are offered in relation to Lazarus's framework.

Keywords: happiness, hope, anger, performance, extraversion

Although a range of emotions has been observed in sport, including anxiety, frustration, disappointment, happiness, hope, and anger (Crocker, Kowalski, Graham, & Kowalski, 2002; Gould et al., 2000; Hanin, 2000; Jones, Lane, Bray, Uphill, & Catlin, 2005; Jones & Uphill, 2004; Lazarus, 2000a; Robazza & Bortoli, 2007; Sève, Ria, Poizat, Saury, & Durand, 2007), it is anxiety that has received by far the most research attention. This is especially true for research that has examined the emotion-*performance* relationship, which is the focus of the present research.

Lazarus's (1991, 2000a) cognitive-motivational-relational (CMR) theory proposes that athletes' specific emotions are each guided by a core relational theme that describes the interaction between the individual and the environment. The core relational theme is a summary of the appraisals that individuals make in assessing the risk and reward involved in a particular situation. For example, the core relational theme of anger is, "a demeaning offence against me and mine" (Lazarus 2000a, p. 242). Each core relational theme has an associated action tendency that directly represents the manifestation of the person's appraisal of the

stimulus in relation to the self (Lazarus, 2000b). The action tendency for anger is, “a powerful impulse to counterattack in order to gain revenge for an affront or repair a wounded self-esteem” (Lazarus, 2000a, p. 243).

Lazarus’s (1991, 2000a) CMR theory proposes that the core relational theme and the associated action tendency will influence performance depending on the complex relationship between the athlete and the situation. For example, anger may negatively impact performance if it draws resources away from the primary task at hand. However, if the physical skill requires a “lashing out” motion toward an aggressor or opponent, performance may be facilitated due to its close association with anger’s action tendency (Lazarus, 2000b). As such, Lazarus’s CMR theory offers a potentially fruitful theoretical framework for investigating the likely complex emotion-performance relationship. Thus, it seems surprising that it has received minimal performance research attention. One reason for this may be that many emotions are best thought of as *post*-performance emotions. For example, for positive emotions, a performer may feel *happy* to have won, *relieved* at having achieved a performance goal, *proud* to have been in the final of a major competition. Similarly, although *anxiety* can be readily conceptualized as a *pre*-performance emotion, other negative emotions are more readily thought of as postperformance emotions. For example, a performer may feel *angry* at having performed below potential, *ashamed* of a particularly poor performance in front of a crowd, *guilty* of letting the coach down with a poor performance.

Although these emotions can be experienced postperformance (Gould et al., 2000), some may also be experienced preperformance and may affect subsequent performance. In addition, there is evidence that positive affect is related to a number of criterion variables, including health, marital well-being, relationship satisfaction, and coping (see Lyubomirsky, King, & Diener, 2005). Further, in the sport domain, Totterdell (2000) found that happiness was positively related to cricket batting average. However, although Uphill and Jones (2007) found some qualitative support for CMR theory, to the best of our knowledge there are no studies that have studied the emotion-performance link within Lazarus’s (2000a) CMR framework. The aim of the current study was to build upon our understanding of the emotion-performance relationship within this framework.

Physical and cognitive subcomponents of performance appear to be differentially affected by emotional arousal (Parfitt, Hardy, & Pates, 1995; Parfitt, Jones, & Hardy, 1990). For example, physiological arousal has been positively associated with performance on aerobic tasks (Parfitt et al., 1995) and strength tasks (Perkins, Wilson, & Kerr, 2001). In addition, heightened emotional intensity may sometimes be beneficial to performance especially if it can motivate individuals to invest greater resources to the task at hand (cf. Eysenck & Calvo, 1992; Fredrickson, 2001; Lazarus, 2000a). Conversely, physiological arousal can be detrimental to performance on tasks that require fine motor control (Noteboom, Fleshner, & Enoka, 2001; Parfitt et al., 1990). Further, attempts to manage emotions have been found to divert cognitive resources from the primary task toward coping strategies (Janelle, 2002). Despite these promising research avenues, the majority of research examining emotional arousal has focused on anxiety and has disregarded other

negative emotions (e.g., anger) as well as positive emotions (e.g., happiness, hope) that display similar or different patterns of physiological activation (Jones, Lavallee, & Thatcher, 2004; Lazarus, 2000b) that might differentially affect performance (Robazza & Bortoli, 2007).

Given the previous promising research with happiness (e.g., Lyubomirsky et al., 2005; Totterdell, 2000), we start with happiness as a positive emotion. In addition, given the obvious theoretical benefits of anger on a purely physical task (i.e., the desire to lash out; Lazarus, 2000a), we explore anger as a negative emotion. To this end, in Experiment 1 we explore the effect of anger and happiness on the performance of physical and cognitive tasks. Specifically, because the action tendency for anger is associated with a lashing out movement (Lazarus, 2000a) that is similar to the task requirements of a maximal force task, we hypothesize that anger will benefit performance on such a task. Conversely, happiness has been shown to be positively related to effective problem solving (e.g., Erez & Isen, 2002; Estrada, Isen, & Young, 1994; Kavanagh, 1987) and signals that all is well and that resources can be committed to the task (Fredrickson, 2001; Lazarus, 2000b). Consequently, we hypothesize that happiness will facilitate performance on the cognitive task.

Experiment 1

Method

Participants. Fifteen physically active students (9 men, 6 women; $M_{\text{age}} = 24.18$ years; $SD = 3.75$) participated in the experiment. All provided written informed consent to participate in the experiment.

Measures

Imagery Scripts. Imagery scripts were composed for the purpose of inducing happiness, anger, and an emotion-neutral affect. The emotion scripts (happiness and anger) were based on Lazarus's (1991, 2000a) core relational themes of happiness and anger, and contained vivid detail regarding stimuli, response, and meaning propositions to elicit physiological, cognitive, and somatic activation consistent with the appropriate emotional state (Cumming, Olphin & Law, 2007; Lang, 1979). The emotion-neutral script outlined the process of brushing one's teeth (see Kavanagh & Hausfeld, 1986). The delivery of the imagery scripts was standardized by recording the scripts onto a compact disc.

Happiness and Anger. To assess the degree to which the emotions were experienced, we presented participants with a Happiness and Anger inventory. Happiness statements were derived from Gould et al.'s (2000) study, which examined athletes' emotions during sport performance. The 10 happiness statements were chosen using a deductive approach. These were *I am ecstatic*, *I am happy*, *I feel elated*, *I feel joyful*, *I feel blissful*, *I feel good*, *I feel pure happiness*, *I am on cloud nine*, *I am full of joy*, and *I feel like smiling*. The inventory also included the 10 state anger statements (*I am furious*, *I feel irritated*, *I feel angry*, *I feel like yelling at somebody*,

I feel like breaking things, I feel mad, I feel like banging on the table, I feel like hitting someone, I feel burned up, I feel like swearing) from the State-Trait Anger Scale (STAS; Spielberger, Jacobs, Russell, & Crane, 1983). Each happiness and anger statement was rated on a 4-point scale (1 = *not at all*, 4 = *very much so*). Spielberger et al. (1983) reported high internal consistency with a Cronbach alpha coefficient of .92. The Cronbach alphas for the current study were .86 for happiness and .90 for anger.

Visual Analog Scale. Although we were exploring Lazarus's (2000a) framework, in which emotions are conceptualized as discrete, we also used a two-dimensional Visual Analog Scale (VAS) to assess the degree to which participants experienced the emotions of happiness and anger before undertaking the experimental tasks. This was simply to verify further that the emotion manipulations had been successful in inducing the appropriate emotions. Although such an approach is in line with Russell's (1980) circumplex model of affect, researchers, including Lazarus (2000a) and Russell (2003), have questioned the usefulness of such two-dimensional models. Indeed, based on this method alone, one would not be able to differentiate between anxiety and anger, for example (Russell, 2003). However, as an adjunct to the questionnaire data, we deemed this method appropriate for gleaned additional discriminatory information about the success of our emotion manipulations. We used a grid (two 200-mm axes each anchored by *not at all* and *very much*) that measured orthogonally the dimensions of arousal and hedonic tone (pleasantness).

Cognitive Task. We used a grammatical reasoning task that was originally developed by Baddeley (1968). This task requires participants to identify whether a sentence describes a letter pair correctly (e.g., *BA: A follows B; True or false?*). We presented participants with a list of 32 such pairs and asked them to complete as many as possible in a 90-s period. Further, we told participants that they would receive 1 point for every correct answer. Cognitive performance was assessed by accuracy (i.e., number of correct responses). Because participants completed the same task on three occasions, the questions were randomized into three different orders (see Baddeley, 1968).

Physical Task. Participants performed a gross muscular peak force task on a Kin Com Muscle Testing adjustable dynamometer (Model 125E+, Chattecx Corporation) as a measure of physical performance. Peak force (in newton meters) was recorded by isometric extension of the right leg. After familiarization with the equipment and task demands, participants kicked as fast and as hard as possible for a period of 5 s. They performed the task twice with a period of 10 s between the two trials. The mean of the two trials was used for analysis.

Procedure

We informed participants that the experiment was an examination of performance under different conditions of emotion and provided them with instructions on how to complete the cognitive and physical tasks. We administered the experimental conditions on different days at approximately the same time of day. Each participant completed the trials individually.

After providing demographic information and written informed consent, participants sat at a desk and the experimenter outlined the emotion that was to be induced during the testing session and asked participants to think of a situation in which they had experienced this emotion. The corresponding imagery script was then presented. When the imagery script had finished participants were asked to indicate how they were feeling on the VAS. The cognitive task was then completed. Immediately after completing the task we asked participants to complete the Happiness and Anger Inventory retrospectively in relation to how they had felt during the task.

Participants then moved to the dynamometer to perform the physical task under the same emotion condition. Upon confirmation that they were seated securely, they performed one warm-up trial to familiarize themselves with the task. We then presented the relevant imagery script. As soon as the imagery script had finished, participants indicated how they felt on the VAS and were reminded to perform the kick “as fast and as hard as you can.” Upon completion of the physical task, the Happiness and Anger inventory was completed retrospectively.

To finish, we offered participants the inducement of a more pleasant emotion (happiness) if they experienced residual unpleasant feelings (e.g., anger); no participants required this service. We finished by thanking and debriefing the participants. The same procedure outlined above was followed for each condition (i.e., happiness, anger, and emotion-neutral). The order of presentation of the emotion conditions was balanced and randomized across participants.

Results

Manipulation Checks

To assess the imagery scripts' efficacy in inducing the respective emotions (i.e., happiness, anger, and neutral) during the physical and cognitive tasks, single-factor repeated-measures ANOVAs were conducted to examine the dimensions of arousal and pleasantness on the VAS, and the subscales of happiness and anger on the Happiness and Anger inventory. One participant failed to provide data in the emotion-neutral conditions and was removed from all analyses. When the assumption of sphericity was violated, we applied a Greenhouse–Geisser adjustment to the degrees of freedom.

Happiness and Anger. There was a significant happiness difference across emotion conditions, both for the cognitive task, $F(1.17, 16.40) = 220.84, p < .001, \eta^2 = .94$, and for the physical task, $F(1.23, 17.25) = 313.06, p < .001, \eta^2 = .96$. Tukey's follow-up tests revealed that participants experienced significantly more happiness in the happiness condition compared with the anger and emotion-neutral conditions (see Table 1). Moreover, there was a significant anger difference across emotion conditions for both the cognitive task, $F(1.14, 16.01) = 54.88, p < .001, \eta^2 = .80$, and the physical task, $F(1.12, 15.72) = 61.44, p < .001, \eta^2 = .81$. Tukey's follow-up tests revealed that participants experienced significantly more anger in the anger condition compared with the happiness and emotion-neutral conditions (see Table 1).

Table 1 Visual Analog Scale (VAS) Arousal, VAS Pleasantness, Happiness, Anger, and Performance Means (SD) for the Three Emotion Conditions in Experiment 1

	Cognitive Task			Physical Task		
	Happiness	Anger	Emotion-neutral	Happiness	Anger	Emotion-neutral
Happiness	***40.33 (6.37)	11.33 (2.23)	29.00 (6.13)	***41.73 (5.32)	11.27 (2.37)	30.27 (5.15)
Anger	13.20 (7.03)	***38.60 (5.82)	25.53 (7.01)	12.93 (7.33)	***40.07 (5.62)	27.13 (6.83)
Arousal Intensity	*7.15 (2.12)	*6.96 (1.78)	3.79 (1.92)	*7.11 (1.86)	*6.80 (2.27)	3.64 (1.96)
Hedonic Tone	***8.92 (0.93)	2.18 (1.62)	*5.39 (0.81)	***8.64 (1.05)	2.49 (1.93)	*5.42 (1.10)
Performance	18.29 (5.53)	19.29 (4.78)	18.93 (5.68)	561.36 (190.66)	*611.29 (203.85)	559.21 (191.75)

Note. Range of possible scores is as follows: arousal intensity, -10 to 10; hedonic tone, -10 to 10; happiness, 0 to 40; anger, 0 to 40.

* $p < .05$, ** $p < .01$, *** $p < .001$.

^a Significantly greater than anger ($p < .001$).

Visual Analog Scale (VAS). The analyses revealed there was a significant arousal difference across emotion conditions, both for the cognitive task, $F(2, 26) = 13.52$, $p < .001$, $\eta^2 = .51$, and for the physical task, $F(2, 26) = 12.48$, $p < .001$, $\eta^2 = .49$. Tukey's follow-up tests revealed that participants experienced significantly greater arousal in the happiness and anger conditions compared with the emotion-neutral condition during both tasks (see Table 1); the anger and happiness conditions were not significantly different from each other during either of the tasks. Further, there was a significant hedonic tone (pleasantness) difference across emotions for the cognitive task, $F(2, 26) = 151.90$, $p < .001$, $\eta^2 = .92$, and for the physical task, $F(2, 26) = 73.53$, $p < .001$, $\eta^2 = .85$. Tukey's follow-up tests revealed that participants experienced more pleasantness in the happiness condition compared with the anger condition and less pleasantness in the anger condition compared with the emotion-neutral condition during both tasks (see Table 1).

The combined results of the VAS and the Happiness and Anger inventory reveal that the attempts to induce the respective emotions were successful. Further, the VAS findings suggest that the emotions of happiness and anger were characterized by high levels of arousal (Lazarus, 1991) and lend support to the proposal that happiness is a more pleasurable emotion than anger (Russell, 1980).

Performance

Cognitive Task. A single-factor repeated-measures ANOVA revealed no significant difference across emotion conditions in the number of correct answers on the grammatical reasoning task, $F(1.43, 18.53) = .52$, ns, $\eta^2 = .04$ (see Table 1).

Physical Task. A single-factor repeated-measures ANOVA revealed a significant difference across emotion conditions for peak force, $F(2, 26) = 4.52$, $p < .05$, $\eta^2 = .26$. Tukey's follow-up tests revealed that performance was significantly greater in the anger condition compared with the happiness and emotion-neutral conditions; there was no significant difference between the happiness and emotion-neutral conditions (see Table 1).

Discussion

The aim of Experiment 1 was to examine the influence of anger and happiness on cognitive and physical aspects of performance. The findings partially supported our hypotheses; participants' performance on the physical task was significantly greater in the anger condition compared with the happiness and emotion-neutral conditions. These results of the experiment are consistent with Lazarus's (2000b) suggestion that anger may facilitate physical performance if the required skill is similar to anger's associated action tendency (i.e., to lash out).

Although the anger results are encouraging, the results for happiness do not support our hypothesis and previous research (e.g., Lyubomirsky et al., 2005; Perkins et al., 2001; Totterdell, 2000). That is, happiness did not produce any significant differences in cognitive performance. A possible explanation of the lack of happiness findings resides in the core relational theme for happiness: "making reasonable progress toward the realization of a goal" (Lazarus, 2000a, p. 234). This suggests that happiness may in fact result in no change in the cognitive

resources committed to the task. That is, the core relational theme of happiness suggests a satiated state: happiness signals that all is well and there is possibly no immediate need or desire to do anything to change this (see also Carver & Scheier, 1998; Mackie & Worth, 1989; Melton, 1995). Given these considerations, it is perhaps not surprising that anger results in significant performance gains (i.e., *I am angry; I want to lash out*) and that happiness does not (i.e., *I am happy; I do not feel the need to do anything*). We explore some alternative explanations of these results in the general discussion following Experiment 3.

The aim of Experiment 2 was to investigate potential performance gains with a more goal-oriented positive emotion. One obvious such emotion candidate is hope. Indeed, the core relational theme for hope is “fearing the worst but yearning for better, and believing the improvement is possible” (Lazarus, 2000a, p. 234; see also Lazarus, 1999), which is more likely to result in greater mental effort. Further, hope is a common preperformance emotion among athletes: despite fear of failure, they hope for the best outcome. Given the core relational theme of hope, we hypothesized that participants who were hopeful would believe that improved performance was possible and would thus invest greater cognitive resources to the successful completion of the task and perform better (Eysenck & Calvo, 1992; Lazarus, 2000a). Conversely, as some cognitive resources might be diverted away from the primary task toward coping strategies when participants were angry (Lazarus, 2000b), we hypothesized that anger would not result in better performance on such a task.

There were two other potential limitations in Experiment 1. First, although positive affect is thought to allow resources to be allocated to the task (cf. Fredrickson, 2001), we did not measure such resources. Second, the task (grammatical reasoning) was of limited relevance to participants, which may have resulted in few resources being allocated to the task. In Experiment 2 we aimed to redress these limitations by developing a more sport-specific task for sport participants and measuring resources via mental effort.

Experiment 2

Method

Participants. Eighteen semiprofessional male British soccer players ($M_{\text{age}} = 21.50$ years; $SD = 2.12$) participated in the experiment.

Measures

Imagery Scripts. Imagery scripts were used to elicit the emotional states of hope and anger for the appropriate conditions (e.g., Cumming et al., 2007; Lang, 1979). The imagery scripts were constructed in the same manner as in Experiment 1 but with some specific reference to football, considering Lazarus’s (2000a) core relational themes for hope and anger. The emotion-neutral condition was the same as in Experiment 1 (i.e., instructing participants to imagine brushing their teeth; cf. Kavanagh & Hausfeld, 1986).

Hope and Anger. This inventory comprised nine hope statements (e.g., *I am hoping to do well on this task*) derived from Gould et al. (2000) and the same 10 state

anger statements from the STAS (Spielberger et al., 1983) as were used in Experiment 1. Each of the hope and anger statements was rated on a 5-point Likert-type scale from 1 (*not at all*) to 5 (*very much so*). The hope statements were: *I feel hopeful, I have hope, I am hoping to do well on this task, I feel hopeless about this task, I have not got much hope, I have faith in my ability, I do not want to perform badly on this task, I don't really mind how I perform on this task, I hope I will perform well on this task*. The hope and anger subscales had high internal consistency with Cronbach alpha coefficients of .89 and .88 for hope and anger, respectively.

The Sport Affect Grid. A Sport Affect Grid (SAG) assessed two independent dimensions of affect: intensity and hedonic tone (pleasantness). The SAG has been used previously in sport research (e.g., Hardy, Hall, & Alexander, 2001) and is presented as a 9×9 grid: the vertical axis assesses the self-perceived intensity of an emotion, ranging from *Extremely Low Intensity* to *Extremely High Intensity*, and the horizontal axis assesses hedonic tone, ranging from *Unpleasant Feeling* to *Pleasant Feeling*. Participants are asked to mark an X on the part of the grid that best represents how he/she feels *right now*. Scores for the intensity and hedonic tone of the emotions were calculated separately by converting the location of the X on each axis to a value from 1 to 9.

Cognitive Task. As the letter transformation task used in Experiment 1 has limited applicability to sport situations, we presented the soccer players with a task that assessed their soccer-related reaction times. This computer task required participants to track the path of an opposing player as closely as possible with the cursor of the mouse while anticipating the appearance of a soccer ball on the screen. When the soccer ball appeared on the screen, participants were to react as quickly as possible by clicking the mouse. The task lasted 45 s with a total of nine soccer balls appearing every 4, 5, or 6 s. The order of presentation of these time periods was randomized within participants. Participants' mean reaction time was retained for analysis.

Perceived Mental Effort Scale (PMES; Mullen & Hardy, 2000). Given the core relational theme of hope, we hypothesized that hope would be associated with an increase in mental effort. Consequently, we asked participants to assess how much mental effort they had invested in the task by completing the PMES: *Based on the most mental effort you have ever used to concentrate before, how would you rate your concentration effort during your performance on the task?* The PMES is scored on a scale of 0 (*No effort*) through 5 (*Moderately effortful*) to 10 (*Most effort ever*).

Procedure

Participants attended the testing sessions individually and we told them that we were studying emotions and soccer-related performance. After the participant had provided written informed consent and demographic information, the researcher explained the experimental task. Participants then sat at a desk in front of a computer monitor and listened to the first imagery script via headphones (i.e., hope, anger, or neutral). After the imagery script, participants completed the SAG and the computer soccer task. Immediately after the task, participants retrospectively completed the Hope and Anger Inventory and the

PMES in relation to how they had felt immediately before the task. Once participants had completed the inventories and had rested for a few moments, we asked participants to stand with their eyes closed and to balance on alternate legs while counting backward in threes from 100 to zero. This was performed between each of the conditions to minimize any carryover effects from one emotion condition to the next.

The order of the conditions (i.e., hope, anger, and neutral) was balanced across participants. After the third condition, we thanked participants for their time, offered them the opportunity to ask any questions, and debriefed them before they left the laboratory.

Results

Manipulation Checks

Hope and Anger. Single-factor repeated-measures ANOVAs were conducted across the three emotion conditions (i.e., hope, anger, neutral). There was a significant hope difference across conditions, $F(2, 34) = 4.60$, $p < .05$, $\eta^2 = .21$. Tukey's follow-up tests revealed that significantly more hope was expressed in the hope condition compared with the anger and emotion-neutral conditions; there was no significant difference in hope between the anger and emotion-neutral conditions. Further, there was a significant anger difference across conditions, $F(1.40, 23.85) = 31.50$, $p < .001$, $\eta^2 = .65$. Tukey's follow-up tests revealed that significantly more anger was reported in the anger condition compared with the hope and emotion-neutral conditions; there was no significant difference in anger between the hope and emotion-neutral conditions (see Table 2).

The Sport Affect Grid. Single-factor repeated-measures ANOVAs were conducted to examine the dimensions of hedonic tone (pleasantness) and intensity across emotions. There was a significant hedonic tone difference, $F(2, 34) = 11.37$,

Table 2 Hope, Anger, Hedonic Tone, Intensity, Mental Effort, and Mean Reaction Times (SD) for the Three Emotion Conditions in Experiment 2

	Emotion Condition		
	Hope	Anger	Emotion-neutral
Hope	40.11* (3.83)	35.33 (7.97)	32.67 (7.77)
Anger	16.33 (6.58)	31.11* (11.72)	11.94 (2.55)
Hedonic Tone	6.94* (2.10)	4.06 (2.28)	5.94* (1.43)
Arousal	7.56* (1.24)	7.94* (1.58)	3.61 (2.00)
Mental Effort	8.06* (1.39)	7.78* (1.48)	4.78 (1.77)
Reaction Time	420.70* (104.73)	424.29 (75.34)	448.91 (88.83)

Note. Range of possible scores is as follows: anger, 0 to 50; hope, 0 to 45; hedonic tone, 1 to 9; arousal, 1 to 9; mental effort, 0 to 10.

* $p < .05$.

$p < .001$, $\eta^2 = .40$. Tukey's follow-up tests revealed that the anger condition yielded significantly lower pleasantness than the hope and neutral conditions. The difference between the hope and emotion-neutral conditions approached conventional significance with greater hedonic tone expressed in the hope condition, $p = .09$. Further, there was a significant intensity difference across emotions, $F(2, 34) = 40.71$, $p < .001$, $\eta^2 = .71$. Tukey's follow-up tests revealed that both the anger and hope conditions were significantly more intense than the emotion-neutral condition with no significant difference between the anger and hope conditions (see Table 2).

These analyses suggest the imagery scripts were successful in inducing the corresponding emotions. Further, they confirm that anger is an unpleasant emotion that is characterized by a high level of intensity (Lazarus, 2000a; Russell, 1980) and that hope is a pleasant and intense emotion (Lazarus, 2000a).

Mental Effort. A single-factor repeated-measures ANOVA revealed that participants' mental effort differed across conditions, $F(2, 34) = 30.75$, $p < .001$, $\eta^2 = .64$. Tukey's follow-up tests showed that the mental effort invested in the hope and anger conditions was significantly greater than in the emotion-neutral condition; there was no significant difference between the mental effort invested in the hope and anger conditions (see Table 2).

Performance

Reaction Time. A one-way repeated-measures ANOVA revealed no significant difference between emotion conditions on reaction time, $F(2, 34) = 2.12$, $p = .14$, $\eta^2 = .11$. However, given that our hypothesis was that hope would yield faster reaction times than no emotion and that anger and emotion-neutral conditions would not differ, we proceeded with these two a priori comparisons. These revealed that the reaction times in the hope condition were significantly faster than in the emotion-neutral condition, $t(17) = 2.47$, $p < .05$, $\eta^2 = .26$, and that the anger and emotion-neutral conditions did not significantly differ, $t(17) = 1.69$, $p = .11$, $\eta^2 = .14$ (see Table 2).

Discussion

The purpose of Experiment 2 was to examine the influence of hope and anger on cognitive performance. The findings largely supported our hypothesis. That is, effort and performance were greater in the hope condition compared with the emotion-neutral condition. In the anger condition, although there was a significant increase in effort, performance was not significantly improved compared with the emotion-neutral condition. This is possibly because the core relational theme of hope (i.e., yearning for better) can be directed to the task at hand. In this way, the hope-associated increase in mental effort was accompanied by an increase in performance, thereby rendering hope the more efficient emotion on this largely cognitive task. Indeed, the action tendency for anger (e.g., lashing out) can less obviously be directed to the cognitive task (cf. Lazarus, 2000a), which is possibly why the anger-associated increase in mental effort was not translated into a significant increase in performance. For anger to be an effective

performance-enhancing emotion it appears that the task needs to be closely aligned with anger's action tendency (e.g., lashing out; Lazarus, 2000a). This was demonstrated in Experiment 1, in which anger was associated with better performance on a maximal force gross muscular task. We discuss the similarity of the anger and hope reaction times further in the general discussion.

The aim of Experiment 3 was to further our understanding of how individual differences might moderate the emotion-performance relationship and specifically this anger-performance relationship. It has long been established (e.g., Hanin, 1980, 2000) that individuals' performance will be affected by their emotional state. For example, Hanin's individual zones of optimal functioning (IZOF) model states that individuals will perform better when they are within their preferred emotional range. In its simplest form, the model predicts that people are different and that their emotions will affect performance differently. Although this is helpful in an applied context, it bears limited theoretical weight. As Gould and Tuffey (1996) noted, the IZOF model is an individual difference model without any individual difference variables. In Experiment 3, we sought to explore a more theoretically derived individual difference approach to the emotion-performance relationship.

With specific reference to anger in the context of developing the results of Experiment 1, extraversion as an individual difference variable appears an obvious potential moderator candidate. Extraverts are sociable and active person-oriented people who will more willingly express themselves in front of others (Goldberg, 1992, 1993), and recent research has revealed a facilitative extraversion and emotional expression effect on performance in the cognitive domain (Perbandt, 2007). Further, Cerin (2004) found that individuals higher in extraversion interpreted their anxiety as more facilitative than individuals lower in extraversion. However, there has been limited research examining the role of emotional expression and personality on physical performance. As Experiment 1 confirmed a facilitative performance effect for anger, it follows that extraverts' willingness to express their anger should translate into greater performance benefits. In other words, the performance-related benefits of expressing anger will be greater for extraverts. This is the hypothesis of Experiment 3.

Experiment 3

Method

Participants. Seventy-two physically active undergraduate students (45 men, 27 women; $M_{\text{age}} = 22.23$ years; $SD = 3.68$) participated in the experiment.

Measures

Imagery Scripts. The imagery scripts from Experiment 1 were used to elicit the appropriate emotions for the anger and emotion-neutral conditions (i.e., brushing one's teeth).

State-Trait Anger Scale. Participants completed the state section of the STAS (Spielberger et al., 1983). In each condition, participants were asked to complete

the scale in relation to how they had felt after hearing the emotional induction script immediately before the task. Each of the anger statements was rated on a 4-point scale (1 = *not at all*, 4 = *very much so*). The Cronbach alpha coefficient for the state anger subscale was .92.

Visual Analog Scale. The VAS from Experiment 1 was used to measure the degree to which participants felt the dimensions of arousal and hedonic tone (pleasantness) before performing the task.

Extraversion. Participants completed the International Personality Item Pool (IPIP; Goldberg, 1993). The IPIP assesses individuals' Big-Five personality markers: Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Intellect/Imagination. The present experiment used the 50-item version consisting of 10 items for each of the Big-Five personality factors. Participants were asked to read each statement and then to rate how well it described them on a 5-point scale from 1 (*very inaccurate*) to 5 (*very accurate*). We used only the data from the extraversion scale (e.g., *I am the life of the party*) for analysis. The Cronbach alpha coefficient for the extraversion subscale was .91.

Physical Performance. Participants performed individually the gross muscular peak force task used in Experiment 1.

Procedure

We told participants that the experiment was an examination of emotion and performance and provided instructions on how to complete the task. After providing demographic information and written informed consent, participants completed the IPIP. We then secured the participant to the dynamometer and he/she completed the strength task following the same procedure as in Experiment 1. The emotions were induced as in Experiments 1 and 2. Participants completed the task individually under anger and emotion-neutral conditions on different days at approximately the same time of day. The order of presentation of the emotion conditions was balanced across participants.

Results

Manipulation Check

State-Trait Anger Scale. A paired samples *t* test on the STAS revealed that anger was significantly greater in the anger condition ($M = 27.57$, $SD = 6.95$) than in the emotion-neutral condition ($M = 11.54$, $SD = 3.74$), $t(71) = 19.11$, $p < .001$, $\eta^2 = .84$.

Visual Analog Scale. We conducted paired samples *t* tests to examine the dimensions of arousal and pleasantness across the two emotion conditions (anger, neutral). Arousal in the anger condition ($M = 144.57$, $SD = 29.45$) was significantly greater than in the emotion-neutral condition ($M = 77.94$, $SD = 43.57$), $t(71) = 11.10$, $p < .001$, $\eta^2 = .63$. Pleasantness in the anger condition ($M = 75.83$, $SD = 40.86$) was significantly lower than in the emotion-neutral condition ($M = 114.96$, $SD = 40.31$), $t(71) = 6.43$, $p < .001$, $\eta^2 = .37$.

Performance

A paired samples *t* test revealed that the mean performance score in the anger condition (377.97, *SD* = 135.86) was significantly greater than in the emotion-neutral condition (301.94, *SD* = 111.16), $t(71) = 8.99$, $p < .001$, $\eta^2 = .53$. This replicates the findings of Experiment 1. To examine the extent to which extraversion allows individuals to glean additional anger-induced performance benefits, we created a performance improvement score (i.e., the ratio of anger and neutral performance scores). Extraversion was significantly related to this improvement score, $r = .21$, $p < .05$, thus suggesting that extraversion facilitates anger-induced performance increments.

To further investigate the potential moderating role of extraversion in the anger-performance relationship, we conducted a 2 (emotion: anger, neutral) \times 2 (extraversion: high, low) mixed-model ANOVA with repeated measures on the first factor and with a median split on the extraversion data. This confirmed a significant main effect for emotion condition, $F(1, 70) = 82.73$, $p < .001$, $\eta^2 = .54$, such that participants performed better in the anger condition than in the emotion-neutral condition. Of more central interest, the ANOVA revealed a significant interaction between emotion and extraversion, $F(1, 70) = 6.90$, $p < .05$, $\eta^2 = .09$, which confirmed that the performance benefits when angry were significantly greater for extraverts than for introverts. One could argue that performing a median split on the extraversion data are insufficient for classifying individuals as extraverts or introverts. Consequently, we conducted the same analysis using quartile splits on the extraversion data. This yielded the same pattern of results. Specifically, a significant main effect for emotion condition, $F(1, 36) = 50.69$, $p < .001$, $\eta^2 = .59$, and a significant extraversion \times emotion condition interaction, $F(1, 36) = 4.71$, $p < .05$, $\eta^2 = .12$. This interaction is illustrated in Figure 1.

Discussion

The anger findings replicated those of Experiment 1. That is, anger resulted in significantly greater performance on a gross muscular task. Further, in support of our hypothesis, extraverts' performance gains were greater than introverts'. These findings are also consistent with recent research examining the influence of personality and emotional expression on cognitive performance and behavior (e.g., Perbandt, 2007; Smits & De Boeck, 2007; Smulders & Meijer, 2008).

General Discussion

Although the role of emotion in sport performance has been widely recognized (Hanin, 2000; Lazarus, 2000a), only limited research has examined the performance effects of emotions beyond those of anxiety. The aim of the present research was to extend our understanding of the emotion-performance relationship by investigating the effect of specific emotions on physical and cognitive aspects of sport performance.

The findings largely support Lazarus's (2000a) theoretical framework. Specifically, if the emotion experienced is aligned with the task demands then it seems

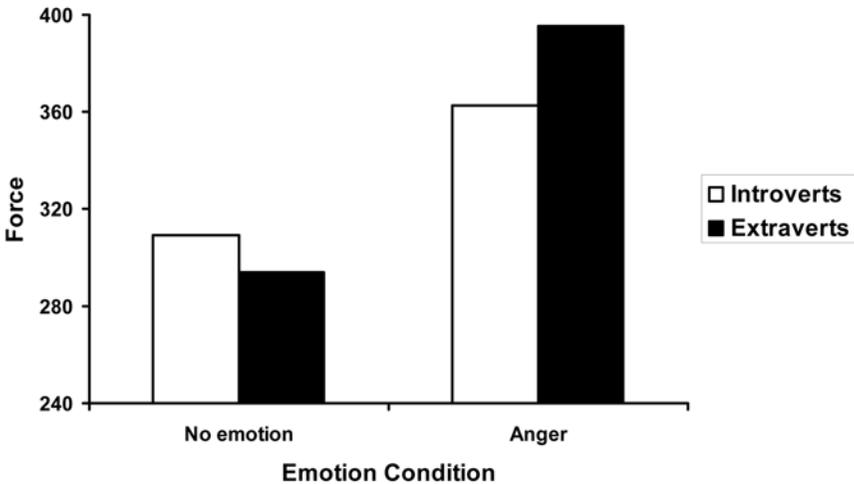


Figure 1 — The significant interaction between emotion condition and extraversion on the maximal force task in Experiment 3.

to facilitate performance. The anger findings are also consistent with applied research on anger in combative and contact sports (e.g., Robazza & Bortoli, 2007; Terry & Slade, 1995). Although hope increased mental effort and reduced reaction time, happiness did not improve performance on a different cognitive task, possibly because it reflects a satiated state where no increase in effort is deemed necessary (also possibly because of task differences, which we address later). As such, in relation to performance, happiness may be most relevant as a postperformance emotion.

The present line of research is clearly in its infancy. Indeed, there is a wealth of research that anxiety researchers have promulgated: the multidimensional nature of anxiety (e.g., Martens, Vealey, & Burton, 1990); different theoretical frameworks including processing efficiency (Eysenck & Calvo, 1992), conscious processing (Masters, 1992), and catastrophe models (Hardy, 1990); the facilitative and debilitating nature of anxiety (Jones, Hanton, & Swain, 1994); the frequency of anxiety-related cognitive intrusions (Hanton, Thomas, & Maynard, 2004); as well as the complex interplay between stress, anxiety, and performance (e.g., Woodman & Hardy, 2001). However, despite promising research findings, there is a relative paucity of theoretically driven research available on other emotions as they relate to sport performance. Furthermore, with specific reference to the current study, we have only investigated linear effects between emotion and performance. Nonlinear relationships is an area that future researchers would do well to address, as there are likely emotion thresholds beyond which the emotion no longer facilitates performance and likely debilitates it, perhaps in a catastrophic manner similar to anxiety (see Hardy, 1990).

Also, as evidenced in Experiment 2, there are likely facets to positive emotions (e.g., hope) that are different to those of negative emotions (e.g., anger)

that may allow the performer to persist longer at a task or to persist more efficiently, for example. Specifically, mental effort played a significant role in Experiment 2, in which participants reported the greatest investment of mental effort in the hope condition (albeit not significantly different from effort in the anger condition). Of course, any associated performance differences across emotions are not likely to be simply categorized by negative and positive emotions, as these are likely intertwined (cf. Levine, 1996). For example, an athlete may hope to win a gold medal while simultaneously fearing that she might have a disaster (cf. Lazarus, 2000a).

Although only hope yielded significantly better performance in comparison with the emotion-neutral condition, the performance difference between the hope and anger emotion conditions was fairly minimal (see Table 2). In addition, both hope and anger yielded an increase in effort invested on the task. Thus, it appears that hope and anger may not be that different in their effects on reaction time. This begs the question: would any arousal-inducing emotion have resulted in an increase in effort and, if so, would any associated effort always be beneficial to performance? This seems unlikely. For example, a conscious processing view (e.g., Masters, 1992) would suggest that effort will debilitate performance if such effort is self-directed whereas other control process views (e.g., Eysenck & Calvo, 1992) suggest that effort can serve a regulatory function and help performance. Although these theories have anxiety as their basis, other emotions may be worthy of investigation within similar frameworks.

Extraversion significantly moderated the degree to which participants experienced anger-derived performance benefits. This is promising because there is a paucity of performance-related research that incorporates athletes' personality. In the current study, we operationalized anger as an intense and unpleasant emotion (Lazarus, 1991; Russell, 1980) and measured it using Spielberger et al.'s (1983) State Anger Inventory. However, there is increasing evidence that anger is a rather more complex emotion (see Russell & Fehr, 1994) including two distinct anger coping styles, most often referred to as *anger-in* and *anger-out* (Averill 1983; Smits & Kuppens, 2005; Spielberger, Reheiser, & Sydeman, 1995). The *anger-in* style refers to the person who experiences anger but keeps the expression of this anger in. The *anger-out* style refers to the person who experiences anger and expresses it outward. However, in the specific context of the present data, these anger styles may reflect the more fundamental personality construct of extraversion. The degree to which anger expression style (i.e., *anger-in* and *anger-out*) may mediate or moderate the extraversion interaction revealed here seems a worthy avenue for future research on anger-performance and the role of individual differences in that relationship.

Limitations and Future Research

Although the cognitive task used in Experiment 2 had greater ecological validity than that used in Experiment 1, neither have strong ecological validity. Future research employing more ecologically valid tasks might allow us to better understand how emotion affects sport-specific performance. Such research might include testing pre-event naturally occurring emotions and their effects on

subsequent subcomponents of performance. This approach would parallel the approach used by Hardy and associates in earlier anxiety research (see, for example, Parfitt et al., 1990).

On the basis of the null findings for happiness in Experiment 1, we suggested that happiness might be better investigated as a postperformance emotion. Indeed, although the happiness manipulation was successful in inducing intense and positive affect, participants' performance did not benefit from such states, which was contrary to our hypotheses and somewhat contrary to previous studies (e.g., Lyubomirsky et al., 2005; Perkins et al., 2001). We initially attempted to explain this finding as happiness reflecting a satisfactory status quo; that is, the happy person feels little need to actively change anything (cf. Mackie & Worth, 1989; Melton, 1995). On this basis, we abandoned happiness in favor of hope in Experiment 2. However, a closer look at Experiment 1 suggests that this abandonment may have been rather premature; another possible explanation for the null findings is that the task used was such that the motivation to engage in it was insufficient. This is quite possible for two reasons. First, the reasoning task was likely not of great interest to participants and certainly not of any direct relevance. Past research (e.g., Lyubomirsky et al., 2005) has found that positive affect does lead to success across a plethora of life domains (e.g., marriage, health), which hold considerably more personal meaning to people than a grammatical reasoning task, for example. In response to this lack of task relevancy, in Experiment 2 we attempted to align the task demands (soccer-related task) with the sample (semiprofessional soccer players) and the effect of hope on performance was evident. Future research would do well to investigate similar paradigms with happiness to ascertain the degree to which happiness might affect performance on tasks that hold more personal meaning for the individual. Second, the task may have been insufficiently challenging to motivate participants. For example, Erez and Isen (2002) found that happiness was associated with better performance but that happiness was motivational only when the task had reached a certain degree of difficulty. This suggests that happiness may only affect performance when it matters most: "when the going gets tough." That is, positive affect may provide both sufficient resources and sufficient motivation to pursue a demanding task (Fredrickson, 2001). This seems particularly worthy of future research in the context of sport performance.

A final limitation in relation to the happiness experiment is sample size, which again suggests that happiness warrants further research attention. Of course, sample size does not explain the hypothesized findings that were obtained for the other emotions (i.e., hope and anger), which suggests that this was not a major shortcoming of these experiments. Further, the anger results were replicated across the experiments despite potential sample size concerns in Experiment 1.

The experiments reported here offer support for the notion that emotions other than anxiety are worthy of research attention when attempting to understand the emotion-performance relationship. However, there is an important shortcoming here (and in all other research on emotions and performance) that is worth considering in future. That is, we did not control anxiety. In other words, we cannot be certain that the anger-performance relationship revealed here does not simply reflect an anxiety finding and that all negative, arousal-inducing, emotions would yield similar results. Future research would do well

to investigate anxiety and anger in conjunction with each other to ascertain the degree to which these emotions might yield differential, additive, or interactive effects on performance.

In summary, Lazarus's (2000a) theoretical framework appears to be a promising avenue for researchers interested in the effect of emotions on performance. Happiness did not affect performance, which may reflect a self-satisfied state although future research needs to explore more demanding and relevant task performance. Hope facilitates performance on reaction time tasks and anger helps performance of gross muscular tasks. Furthermore, extraverts benefit most from such anger-induced physical performance increases. The results of the present studies suggest that emotions other than anxiety deserve further attention.

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