Running head: EMOTION REGULATION AND TRACK RUNNING PERFORMANCE

How should I regulate my emotions if I want to run faster?

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Abstract

The present study investigated the effects of emotion regulation strategies on self-reported emotions and 1600m track running performance. In stage 1 of a three-stage study, participants (*N* = 15) reported emotional states associated with best, worst and ideal performance. Results indicated that a best and ideal emotional state for performance comprised of feeling happy, calm, energetic, and moderately anxious whereas the worst emotional state for performance comprised feeling downhearted, sluggish, and highly anxious. In stage 2, emotion regulation interventions were developed using online material and supported by electronic feedback. One intervention motivated participants to increase the intensity of unpleasant emotions (e.g., feel more angry and anxious). A second intervention motivated participants to reduce the intensity of unpleasant emotions (e.g., feel less angry and anxious). In stage 3, using a repeated measures design, participants used each intervention before running a 1600m time-trial. Data were compared with a no treatment control condition. The intervention designed to increase the intensity of unpleasant emotions resulted in higher anxiety and lower calmness scores but no significant effects on 1600m running time. The intervention designed to reduce the intensity of unpleasant emotions was associated with significantly slower times for the 1st 400m. We suggest future research should investigate emotion regulation, emotion and performance using quasi-experimental methods with performance measures that are meaningful to participants.

Keywords: Emotion regulation, emotion, meta-emotional beliefs, psychological skills, endurance performance.

How should I regulate my emotions if I want to run faster?

Evidence indicates that self-reported emotions are predictive of performance (Beedie, Terry, & Lane, 2000; Hanin, 2003, 2010; Lazarus, 2000), and that athletes engage in strategies to regulate their emotions in order to enhance performance (Lane, Beedie, Jones, Uphill, & Devonport, 2012; Wagstaff, 2014). Although emotion regulation is relevant to all sports, in endurance performance, emotion regulation and fatigue regulation are highly intertwined. Noakes (2012) argued “fatigue is principally an emotion, part of a complex regulation, the goal of which is to protect the body from harm” (p. 2). Evidence demonstrates that runners use emotion regulation strategies without formal training, and that many of these resemble traditional psychological skills such as imagery, self-talk and goal setting (Stanley, Lane, Beedie, & Devonport, 2012).

Lane et al. (2012) argued there are at least two distinct motivations to regulate emotion – hedonic and instrumental. Hedonic emotion regulation is characterised by trying to increase the intensity of pleasant emotions and reduce the intensity of unpleasant emotions. A great deal of research suggests that this approach to emotion regulation could yield positive performance (Beedie et al., 2000; Hanin, 2010; Morgan, 1980; Raglin, 2001). In contrast, an instrumental approach to emotion regulation is one in which an athlete seeks to feel emotions that will help performance. For example, some athletes believe that anxiety enhances performance and will up-regulate that emotion accordingly whilst others believe anxiety hampers their performance and attempt to reduce its intensity (Hanin, 2010; Lane, Beedie, Devonport, & Stanley, 2011; Stanley et al., 2012; Stanley, Beedie, Lane, Friesen, & Devonport, 2012),

Emotion regulation during endurance sport is proposed to be influenced by progress toward goal achievement (Baron, Moullan, Deruelle, & Noakes, 2011; Beedie, Lane, & Wilson, 2012; Noakes, 2012; Lane, 2001; Wilson, Lane, Beedie, & Farooq, 2012). Lane (2001) reported that an emotional state comprising anger, tension and vigor associated with high goal-confidence, while depressed mood and very high tension associated with low goal-confidence. Lane and Wilson (2011) reported high scores of emotional intelligence associated with pleasant emotions in a multi-stage marathon race. Wilson et al. (2012) conducted an experimental study where participants were provided false feedback by informing riders they were 5% behind (negative) or ahead (positive) of their self-set goal. Compared to false positive feedback conditions, false negative feedback associated with an unpleasant emotional profile characterized by higher anxiety, anger, and sadness. Further, it also associated with higher lactate and oxygen usage. False negative feedback also produced an erratic pacing strategy compared to false positive feedback. In negative feedback conditions participants attempted to ride faster, producing spikes showing high power output, followed by periods of low power output. However, despite different pacing strategies between conditions, no significant difference in completion time was found between false negative and false positive conditions.

An optimal pacing strategy is one that ensures energy expenditure is appropriately regulated (Tucker & Noakes, 2009). Such regulation is probably a learned pattern, determined by an athlete’s perceptions of the intensity required to complete a defined distance as fast as possible; a process that is influenced by past experiences (Micklewright, Papadopoulou, Swart, & Noakes, 2010) and emotions (de Koning et al., 2011; Tucker & Noakes, 2009). A key factor determining the pacing strategy favored is the duration of the exercise bout. Although an even-paced strategy has been suggested to be the optimal pacing strategy, it appears that best performance is achieved by a maximal start and progressive slowing down for shorter-duration track running events (Tucker, Lambert & Noakes, 2006). In contrast middle- and long-distance events are characterized by a fast start, a period of slower running, and increase in speed towards the end (Noakes, Lambert, & Hauman, 2009; Tucker et al., 2006). With regard to the latter strategy, if negative feedback leads to increased anger and anxiety, which in turn associates with bursts of effort, then unpleasant emotions could be helpful. Extending this logic to methods an athlete might use to develop her/his own emotion regulation strategies, if they believe anxiety helps performance (Hanin, 2010; Lane et al., 2011), then arguably, negative self-talk might help her or him perform better via repeat bouts of intense effort.

The aim of the present study was to extend examination of emotion regulation and pacing in cycling (Beedie et al., 2012; Wilson et al., 2012) to running performance. In contrast to the deceptive methods used by Beedie et al. (2012), the present study used guided self-regulatory methods to alter emotion. The approach is a logical extension of previous research as evidence shows runners use self-regulation strategies as part of preparation for competition (Stanley, Beedie et al., 2012; Stanley, Lane et al., 2012). We investigated the effects of strategies designed to increase or decrease the intensity of unpleasant emotions, on emotion, pacing strategy and overall 1600m track running performance. Hypothetically high anxiety or anger would lead to a fast first 400m. However, in terms of overall 1600m performance, we hypothesized that overall finish times would not be significantly different between conditions, a finding consistent with Beedie et al. (2012).

**Method**

**Participants**

Fifteen runners (Male: *n* = 8, Female: *n* = 7; age 27.41 years, SD = 8.44 years) participated in the present study. The inclusion criteria was as follows: participants needed to be runners who trained regularly, as defined by engaging in more than one training session per week, and had race experience, defined as having raced in the previous 12 months. Participants were recruited via the project website which indicated that they would need to run three 1600m time trial runs in one session. Participants reported competing in events ranging from 5km to marathon distances and running an average of 20.55 miles (SD = 19.75 miles) per week, hence the distribution in training status varied. None of the participants had previously worked with a sport psychologist.

**Measures**

**Emotions**

Emotions measured were: “Calm,” “Happy,” “Energetic,” “Sluggish,” “Downhearted,” “Angry” and “Anxious” taken from a previously validated scale (Terry, Lane, & Fogarty, 2003). The scale was purposefully short as participants completed this measure 6 times over the duration of the data collection session. The scale was used to assess emotion associated with best and worst performance and was also completed prior to each of three 1600m time trials.

**Performance**

Performance was a 1600m maximal time trial on a standard 400m outdoor running track. Time was recorded for each 400m to facilitate examination of pacing strategy. We compared actual lap time with the average lap time (run time/4) calculated from total 1600m completion time.

**Procedure**

Following institutional ethical approval, participants were recruited into the present study via a link hosted on the Runners World website and the website of the research team. The study was then conducted in three distinct stages.

The purpose of stage 1 was to establish emotions associated with best and worst performance for each participant. The rationale for this process was to facilitate the development of an individualized emotion regulation intervention for each participant. Participants completed an informed consent form and provided demographic information including previous running experience. They then recalled emotions associated with best and worst running performance. They also estimated an emotional state that they believed represented an ideal, one in which they would produce a peak performance. Participants were provided with personal feedback via email describing the emotional state associated with best, worst and ideal performance.

When seen collectively, there were large differences in emotions proposed to be associated with ideal, best and worst performance (Wilks' Lambda = .66, p < .001, Partial Eta2 = .34), with a significant difference between each condition (Best vs ideal: Wilks' Lambda = .30, Partial Eta2 = .70, p < .001; Best vs worst: Wilks’ lambda = .28, Partial Eta2 = .71, p < .001; Worst vs ideal: Wilks’ lambda = 19, Partial Eta2 = .81, p < .001, see Figure 1, Table 1). The emotional state associated with ideal performance was characterised by feeling happier, calmer, and more energetic, less anxious, sluggish, and downhearted than emotions associated with best and worst performance (Figure 1). This suggested that regulation efforts should be motivated hedonically. However, the notion that unpleasant emotion might help performance was evident in the anxiety data where results suggest that moderately intense anxiety associated with best performance (see Figure 1).

The aim of stage 2 was to develop personal emotion regulation interventions. Participants were asked to reflect on their emotional profiles and consider what strategies they use to regulate emotions in training and competition (see Stanley, Beedie et al., 2012). Material to support these reflections was made available via a video hosted on the project website and YouTube (websites to be inserted later). Feedback was provided electronically via email. As expected, and consistent with findings reported by Stanley, Beedie et al. (2012), participants reported strategies that they used to modify emotions. For example, in order to decrease the intensity of unpleasant emotions, participants reported changing perspective and modifying physiological manifestations of emotions via, for example, deep breathing. To increase the intensity of unpleasant emotions, participants reported reappraisal of the situation by raising its importance. They indicated that the challenge was not to raise anxiety, but to regulate it to an optimum. Participants reported meta-emotional beliefs that anxiety can help energize them for a good performance. However, participants also noted that getting the balance just right between optimal levels of anxiety and excessive anxiety was difficult to attain.

[Insert Table 1 about here]

[Insert Figure 1 about here]

The aim of stage 3 was to use quasi-experimental methods to test the effectiveness of emotion regulation interventions developed in stage 2. A no-treatment condition was used as a control. Participants completed three 1600m time trials. They received no verbal feedback relating to their performance and no time data. All trials were undertaken individually so as not to introduce interpersonal competition. Although weather conditions varied, the emphasis of the analysis is on within-subject variation and therefore adverse weather did not adversely influence the aim of the study. Each participant completed 3 x 1600m in similar conditions.

The order in which the interventions were presented was randomized. After using an emotion regulation strategy (where applicable) participants rated their emotional state. Results revealed that there was no significant order effect (Wilks' Lambda = .68, Partial Eta2 = .17, p = .47).

**Results**

**Effects of interventions on self-reported emotions**

 Repeated measures MANOVA indicated a significant intervention effect (Wilks Lambda 14,66 = .38, p = .002, Partial Eta2 = .38) for differences in emotion between intervention and no-treatment conditions. Follow up analysis (see Table 2) indicated higher anxiety and lower calmness following an intervention designed to increase the intensity of unpleasant emotion. However, there were no significant differences in emotions between no-treatment and unpleasant emotion reduction conditions.

**Effects of interventions on 1600m running performance**

Repeated measure ANOVA results indicated no significant intervention effect. Therefore compared to no-treatment, interventions did not significantly improve or worsen 1600m running time (F 2,41 = .26, p = .78). However, results indicated significant interaction effects (F 3,37 = 5.75, *p* < .001, Partial Eta2 = .29). As Figure 2 indicates, interventions designed to reduce the intensity of unpleasant emotion were associated with significantly slower running times for the first 400m compared to the interventions designed to increase the intensity of unpleasant emotion and no-treatment. Results indicated that there was a main effect for pacing with participants recording faster times for the 1st 400m, slower times for laps 2 and 3 with a faster time for the final 400m (F 3,37 = 35.05, p < .001, Partial Eta2 = .74).

[Insert Table 2 and Figure 2 about here]

**Discussion**

The present study investigated the effects of strategies designed to increase or decrease the intensity of unpleasant emotions, on emotion, pacing strategy and overall 1600m track running performance. Previous research has found that emotions influence performance (Beedie et al., 2000; Hanin, 2003, 2010; Lazarus, 2000), and emotion regulation strategies are a common approach to mental preparation (Lane et al., 2012; Wagstaff, 2014). Data indicate that an intervention designed to raise the intensity of unpleasant emotion led to increased anxiety and reduced calmness in comparison to the no-treatment and intervention to reduce the intensity of unpleasant emotion condition. No significant difference in the intensity of emotions was observed between the intervention designed to reduce the intensity of unpleasant emotion and the no-treatment condition. We suggest that in the no-treatment conditions, a number of non-conscious emotion regulation strategies were employed which served to regulate emotion to the ideal emotional state.

During the development of the interventions, participants reported that regulating anxiety via reducing its intensity was a common approach, and therefore it was possible that the no-treatment condition was contaminated with well-learned and possibly automated strategies used to reduce the intensity of anxiety. As Stanley, Beedie et al. (2012) report, there are many thoughts and actions that act as emotion regulation strategies that athletes might not recognize as such. For example, warming up is done ostensibly to prepare for physical performance, but in doing so, warming up might increase beliefs in readiness to perform and reduce anxiety. Lane (2001) found that perceived readiness to perform associated with pleasant emotions with perceived readiness a factor comprising perceptions of physiological states. In the present study, emotion regulation interventions involved active training such as intentionally saying words to oneself or via imagery. Thus warming up could have acted as an emotion regulation treatment.

In terms of the effects on performance, results suggest that emotion regulation strategies did not significantly improve or worsen time to complete 1600m, a finding consistent with previous research (Beedie et al., 2012; Wilson et al., 2012). Interrogation of performance involved investigating the effects of emotion regulation on the intensity of pre-run emotions and pacing. In the present study, the pacing strategy followed in each condition was to run a faster time for the 1st 400m, slower times for laps two and three and a faster time for the final lap (see Figure 2). However, although there was no significant difference in finish time to complete the 1600m, reducing the intensity of unpleasant emotions condition was associated with higher calmness and running a slower first 400m and overall a more consistent pacing strategy than the other two conditions. However, following the above strategy did not associate with lower anxiety than following the no-treatment conditions, and the pacing strategy in the no-treatment condition also associated with running first lap time at a similar speed to the increasing unpleasant emotion condition. Hence, it appears the emotion regulation intervention influenced emotions experienced and the pacing strategy, but not the overall performance. A participant should be clear on the relative pace he or she intends to start and the consequences of such a strategy on emotions experienced during performance and finish time itself.

Although fast start and finish approach to pacing is consistent with those reported for successful performance in middle distance performance (Noakes et al., 2009; de Koning et al., 2011; Thiel et al., 2012), it also associates with the highest ratings of perceived exertion. Research indicates that intense fatigue associates with a combination of unpleasant emotions and thoughts that signal stopping or slowing down (Noakes, 2012). Noakes argues that emotions and fatigue act as a safety valve to provide information that the individual is not coping physiologically, thereby prompting a response. Clearly, following this pacing strategy would require participants to have a high level of motivation to try to run fast when experiencing intense sensations of fatigue, and overriding the signal to slow down goes against an evolved mechanism for survival (Baron et al., 2011; Noakes, 2012).

The ability to follow a pacing strategy requires self-control and recognition of emotional states, especially over the 1st part of the run before fatigue becomes the salient feeling. The self-regulatory component of pacing is important as an athlete makes judgments as to whether performance will meet expectations using ongoing feedback. In the present study, participants had neither access to their running time nor could they attempt to gauge pace by following other runners, and so relied on ongoing kinesthetic feedback. Previous research has reported that in the absence of feedback, participants reported increased unpleasant emotions. For example, in the no-feedback condition, Beedie et al. (2012) reported that ongoing emotions were similar to those experienced in a negative feedback condition where participants experienced intense anxiety. We suggest that the absence of feedback during the run could have acted as a stressor and contributed to results showing similar data between the increasing the intensity of unpleasant emotions and no-treatment conditions. We suggest that future research should examine the effects of ongoing feedback and assess emotions within performance. One way of helping an athlete pace a run is to allow them to be paced by another runner. The use of pacers would allow runners to control pace in order to counteract the effects of anxiety of pace judgment.

In the present study, we attempted to develop individualized emotion regulation interventions by guiding participants to develop and refine the strategies that they already used (Stanley, Beedie, et al., 2012). This followed a process suggested in a recent review by Lane et al. (2012). The interventions used to guide emotion regulation were developed via electronic communication. This approach minimizes possible practitioner effects (Andersen, 2006). Although not commonly used in sport psychology, evidence from other areas of application lends support to the utility of online support (Gaffiney, Mansell, Edwards, & Wright, 2013). We suggest further research is needed to investigate the efficacy of brief interventions delivered electronically. If such interventions were found to be effective, then it would be possible to provide resources that allow athletes to self-regulate their emotions. Cugelman, Thelwall, and Dawes (2011) argued that with over 2 billion internet users, the potential reach of interventions is huge. The present study represents a start point to that process and future research should look to increase the sophistication of the intervention used and offer standardized feedback (Gaffiney et al., 2013).

A desirable feature of the present study is the use of a quasi-experimental design. A great deal of emotion research has used a correlational design. Michie, Rothman, and Sheeran (2007) examined the utility of research designs to test interventions in health and argued that control group data is necessary to control for effect of intention on behavior. Correlational studies cannot rule out the possibility that intention caused behavior change (Webb & Sheeran, 2006) and a great deal of research on emotion in sport has used a correlational design (Hanin, 2010; Lane et al., 2012). The present study developed an individualized intervention that not only formed part of a scientific study, but also was also useful for participants. The present study tested the effects of the intervention, although an acknowledged limitation is that multiple measures were not used for each condition. We suggest that the method of developing an emotion regulation strategy and testing it in controlled conditions such as track running could be something participants could do as a regular part of training.

An acknowledged limitation is the small and heterogeneous nature of the participant sample (in experience and level of performance). We suggest future research should investigate extremes of the population separately. For experienced runners, research should investigate the use and effectiveness of existing self-regulation strategies on managing anxiety and its resultant impact on performance. For inexperienced athletes, research should investigate the effects of anxiety on performance, and explore the strategies people use to manage emotions. Given research evidencing dropout among inexperienced athletes (Dishman, 1982), it would be prudent to examine the extent to which these describe thoughts related to wishing to cease running. A second limitation is that testing was done on one day and residual effects of one intervention on another and fatigue could have been influential. Although evidence found no significant order effect, holding data collection on different days would seem prudent.

The one practical recommendation stemming from the present study is to that participants should investigate the effects of self-help interventions as part of their training. A participant could replicate the present study with minimal support from others, and via using such methods identify the intervention that helps her/him feel and perform better. Evidence shows runners use self-regulation strategies as part of mental preparation (Stanley, Beedie et al., 2012) although do not have systematic methods to evaluate the effectiveness of these strategies. One implication of the present study is that athletes should use systematic methods to assess the effectiveness of self-regulatory interventions.

In conclusion, the present study examined the effects of interventions to intensify or dampen unpleasant emotion before running a 1600m maximal time trial. Results show participants could enact interventions to alter anxiety and calmness. It is suggested that future research examines the use of strategies intended to help athletes perform optimally by using a pacing strategy that serves their goals.

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