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Original article

Emotions and performance in rugby

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Abstract

Purpose: This study investigated emotion–performance relationships in rugby union. We identified which emotions rugby players experienced and the extent to which these emotions were associated with performance, considering how emotions unfold over the course of a game, and whether the game was played at home or away.
Methods: Data were gathered from 22 professional male rugby union players using auto-confrontation interviews to help identify situations within games when players experienced intense emotions. We assessed the intensity of emotions experienced before each discrete performance and therefore could assess the emotion–performance relationship within a competition.
Results: Players identified experiencing intense emotions at 189 time-points. Experts in rugby union rated the quality of each performance at these 189 time-points on a visual analog scale. A Linear Mixed Effects model to investigate emotion–performance relationships found additive effects of game location, game time, and emotions on individual performance.
Conclusion: Results showed 7 different pre-performance emotions, with high anxiety and anger associating with poor performance. Future research should continue to investigate emotion–performance relationships during performance using video-assisted recall and use a measure of performance that has face validity for players and coaches alike.

Keywords: Emotion; Game location; Game time; Linear Mixed Effects model; Multilevel analysis; Performance assessment; Team sport

1. Introduction

Evidence indicates that athletes experience different emotions before and during competition that may influence performance.[1,2] Emotions usually encompass 3 types of response: physiological such as increased respiration and heart rates; cognitive such as the changes in attention, perception, and information processing priorities; and behavioral such as aggression toward an opponent or displaying disgust at an official's decision.[3] Via these 3 types of response, emotions can be functional or dysfunctional. For example, in terms of being functional, the emotions of anger and fear could motivate individuals to deal with the causes of those emotions (the "fight or flight response"). The same emotions could be dysfunctional, if for example, an athlete is angry about an official's decision, and recognizes that an aggressive response might result in a penalty. In such a situation, maintaining the current emotion might be dysfunctional for performance.

A plethora of research has analyzed emotion–performance relationships in sport. In that sense, a recent systematic review on emotions in contact team sports showed a predominance of the study of anxiety and anger among research focusing on performance.[4] Possibly the most commonly used theory is the cognitive motivational and relational theory (CMRT).[4] In the CMRT, emotions are conceptualized as a consequence of a dynamic transaction between individual and context. An examination of the CMRT in sport literature indicates several issues emerge. First,

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although emotions are transitory[5–7] and can change from moment to moment, research has focused on emotions in a single time-point, typically the intensity of emotions experienced before competition.[4,8–10] Yet, during competition, the emotions players experience will change over the time of a long-duration game.[9–11] Further, evidence[12–14] in team sports suggests that halftime is a key point where emotions could change. Thus changes in emotions could explain why some studies observed differences in performance levels between halves (in rugby) or sets (in volleyball) during competition.[13,14]

Secondly, in CMRT,[4] context could influence emotions and 1 contextual factor that has been studied in sport is game location.[15] Evidence indicates that athletes reported an increase in the intensity of anxiety in the week leading up to the game when playing away in comparison to when playing at home.[16] Further, rugby players were found to exhibit higher aggression levels at home games compared to away games.[17] Furthermore, in the home advantage literature in sport, numerous studies demonstrate relationships between game location and performance.[18] From an analysis of data from 9472 games, results demonstrated a clear home advantage in team sports.[18] Home advantage effects could be explained via factors such as crowd effects, travel, familiarity, territoriality, referees bias, and psychological factors such as emotions.[18–22] Therefore, in examining relationships between emotions and performance, the potential influence of contextual variables such as game location should be considered.

In addition, research investigated the quality of performance in team sports in relation to emotions by using a number of different indicators. These indicators include the outcome of the game (or the game scorings),[23] performance on a specific task,[24] physical performances,[25] match play statistics,[26] or via self-report measures with categorical criteria (e.g., poor, average, and good).[27] Yet, these ways of measuring performance might not be sufficiently sensitive to detect the relatively subtle influence of emotions. With regard to game outcome, it is misleading to assume that all teammates share the same emotional state. One player could be happy with her/his own performance, while her/his teammates are in a negative emotional state. Therefore, the win–loss (or success—failure) dichotomy does not produce an adequately sensitive measure, and it may be acknowledged that a specific technical or physical task does not fully represent athletes' performances during competition. The same limitation can be applied to the use of game statistics, which are based on physiological criteria and on technical actions when a player is in the heart of the game situation only (e.g., tackles, passes, and kicks). With regard to self-assessments of performance, it is possible that each athlete would use different subjective criteria, and therefore, clouding the value of the performance variable analyzed with emotions experienced. When seen collectively, performance in team sport is complex and the question of how team and individual performances should be measured is a challenge. We suggest that given the potential influence of emotions on performance, researchers should seek to develop better measures of performance that would allow a meaningful analysis of emotion–performance relationships. One way to do this is to examine discrete emotion–performance relationships for each individual and assess emotion immediately before performance, and then rate the quality of performance. Clearly, it is not practical to assess emotions within performance and so retrospective methods represent a useful solution, but which carries limitations due to accuracy and bias.[28]

In summary, past research has not examined the influence of emotions on performance considering the potential influence of game time and location (home or away). The nature and intensity of emotions are proposed to change over the course of a game.[8,14] Therefore, it would seem prudent to investigate emotion–performance relationships taking multiple measures of emotions experienced just before subsequent performances within a game (i.e., pre-performance emotions). This would allow researchers to examine how these relate to variations in performance. Moreover, regarding the co-influence of context and time on both performance and emotions, it seems also necessary to investigate associations between emotions and performance, considering potential interaction effects between context and time. Lastly, because of the underlined limits of existing performance measurements, it seems coherent to investigate the emotion–performance relationships with a tool adapted to meet the complexity of the sport studied.

The current research proposed to address these issues by examining the primary influences of emotions on players' individual performance in rugby union games, considering pre-performance (and not pre-competitive) emotions, and concomitant effects of game time and location.

2. Methods

2.1. Participants

Twenty-two professional rugby union players (27.6 ± 3.7 years, mean $\pm$ SD) volunteered to participate. Each player was a full-time professional, training and playing between 30 and 51 h per week (organizational time included). The participants have given their informed consent and were voluntary to participate in this study.

2.2. Procedure

Permission to conduct the study was granted by the Lyon 1 University's Human Research Ethics Committee. The adopted recruitment, data collection, and data storage procedures followed the ethical standards of the American Psychological Association.

A semi-structured format was used for the interview schedule, and each participant was asked the same central questions to ensure consistency.[29] Each player was interviewed twice (interview duration: 40.3 ± 13.2 min) regarding a home match and an away match. To get a more representative view of game experiences, we drew from a pool of the last game of the season where stakes were high. Eight games were studied, with 5–6 players interviewed per game.

During the interview, players were asked to recall intense emotional episodes that they may have experienced in the game and to describe which emotions they felt. To ensure that the emotions described were experienced as intense, intensities were assessed by players on a 10-cm visual analog scale

(intensity rating: 7.5 ± 1.1), where the anchors were "no emotion intensity" and "emotion as intense as possible".

To facilitate the recall process,[4] videos of the incidents chosen by participants were used during the interviews.[10] All interviews were conducted approximately 2 days after the competition (interval: 2.1 ± 0.7 days) by the first author who is experienced in qualitative methods.

2.3. Data analysis

For each emotion identified by a participant, we associated (1) the measurement of subsequent performance, (2) the game time, and (3) the game location (i.e., home *vs*. away games). Emotion data were converted into categorical data.

2.3.1. Emotions identification

Following a deductive content analysis, narrative data were regrouped using a predetermined set of categories based on core relational themes as defined by CMRT.[4,5] Thus, we were able to deductively categorize the emotions reported by the participants according to descriptions from CMRT.[4] Through an inductive approach, we also were able to classify other emotions not considered by Lazarus' theory, such as serenity.

Data credibility was mainly achieved in the following 3 ways: (1) independent coding of the data, (2) checking of the categorization process by researchers with experience in qualitative methods, and (3) an invitation to the participants to comment on the researchers' interpretations.[30]

2.3.2. Context and time factors identification

We based the determination of the contextual and temporal variables on the findings from rugby performance studies and on the literature of emotions and performance in rugby.[4,13,31] Using these guidelines, we considered the elapsed game time as a temporal variable, and game location as a contextual variable. All of these variables were determined using videos of the games.

2.3.3. Performance measurement

Difficulties abound in the assessment of any given player in team sports because the player is embedded in a complex and interactional system.[32] Accordingly, some authors argued for the importance of considering technical, but also, tactical variables.[31–33] Thus, they assert that observation is a more valid and sensitive tool for performance measurement in team sports because it considers the interactions of all variables that contribute to individual performance. With these issues in mind, we employed a visual analog scale with which an observer selected a position along a continuous 10-cm line, where the anchors were "worst performance" and "best performance". We asked 2 experts to consider technical and tactical performances in interaction. Then, we asked experts to base their evaluations on several elements suggested in team sports literature: interaction of intervening elements, balance of power,[4] interaction among teammates and coherence with the team's strategy.[32] Although sports performance is difficult to assess directly,[34] this instrument appears to be a suitable proxy measure. To minimize any bias related to the subjectivity of a single person, the 2 experts were asked to assess independently each performance studied. Then, an average of both assessments for each performance was calculated to determine the players' performances. The inter-observer reliability was calculated to examine the consistency of the data.[31,32] The intraclass correlation, considering a 2-way analysis of variance with random raters and a single score (i.e., model (2, 1)),[35] was satisfactory: intraclass correlation coefficient (2, 1) = 0.82 with a 95% confidence interval: 0.774 < intraclass correlation coefficient < 0.866.

2.4. Statistical analyses

A Linear Mixed Effects model[36] (LME model, also called *Multilevel Analysis* or *Hierarchical Linear Modeling*) was used to model the performance dependent variable. The player was coded in the LME model as a random independent variable. The independent variables measuring the emotions and the 2 variables representing the sporting context (location) and the game time were coded as fixed effects. The time variable was introduced in a particularly innovative way by generating a rescaled version (Time%) used in conjunction with the half of the game information (Appendix). Possible trend differences could then be detected for each half of the game.

First, simple descriptive statistics for the dependent and independent variables were computed. Second, to select the best LME model for explaining performance, a descending algorithm was used based on the minimization of Akaike's Information Criterion.[37] Third, the final model was estimated by restricted maximum likelihood. Fourth, interesting significant effects were plotted with respect to the general mean performance. All computations were performed with the help of the free-distribution R 2.10.1 (R Core Team, Vienna, Austria) software and the *nlme* package.[38]

3. Results

The qualitative analysis of narrative data yielded 10 competitive emotions: anger, anxiety, guilt, happiness, hope, pride, relief, sadness, serenity, and surprise. For purposes of this study, only emotions that were experienced before an individual performance incident (pre-performance emotions) were included in the analysis; subsequent emotions experienced after incidents (post-performance emotions) were excluded. Application of this restriction resulted in the removal of guilt and relief. Also, sadness, pride, and surprise were observed less than 10 times: sadness ($n = 6$), pride ($n = 7$), and surprise ($n = 8$). Consequently, they were not used in the subsequent modeling process. This left anger ($n = 16$), happiness ($n = 19$), serenity ($n = 22$), hope ($n = 27$), and anxiety ($n = 102$) as the emotions of interest.

Results showed that 189 measurements of performance were identified. On a 10-point scale, the performance was 5.50 ± 2.47 (mean ± SD). The frequencies of the sporting context and temporal variables appeared to be reasonably balanced (Table 1).

The descending algorithm eliminated 3 emotion variables (serenity, hope, and happiness) and the interaction term from the time variable transformation. The final model was as

Table 1
Observed frequencies for the sporting context and temporal variables.

Sports variables	Frequencies ($n = 189$)
Location	
Home	90
Away	99
Time (min)	
$t \leq 20$	55
$20 < t \leq 40$	27
$40 < t \leq 60$	32
$t > 60$	75
Halftime	
First	87
Second	102

Table 2
Estimation by restricted maximum likelihood of the final model.

Variables[a]	Estimate	SE	*df*	*t* value	*p* value
(Intercept)	8.00	0.66	160	12.02	0.000
Location (HG)	0				
Location (AG)	−1.76	0.51	160	−3.39	0.000
Halftime (1st)	0				
Halftime (2nd)	−2.40	0.84	160	−2.83	0.005
(Time% − 50)	0.04	0.01	160	3.34	0.001
Anger (no)	0				
Anger (yes)	−1.79	0.63	160	−2.84	0.005
Anxiety (no)	0				
Anxiety (yes)	−1.05	0.35	160	−2.98	0.003

Notes: Values are given on the 10-point performance scale. For instance, the estimate (−1.76) for Location (AG) means that performance decreases by this amount when playing away games (compared to home game).
[a] Performance = Location + (Time% − 50) + Halftime + Anger + Anxiety, random = Player. For the qualitative variables, estimate of the first category was fixed to 0.
Abbreviations: AG= away game; HG= home game.

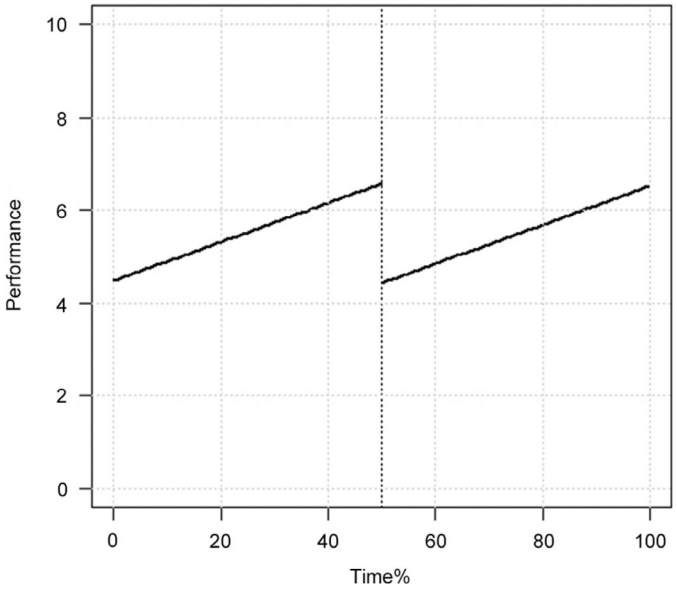

Fig. 1. Time effect on individual performances (values were centered with respect to the general mean performance: 5.50).

follows:

$$\text{Performance} = \text{Location} + (\text{Time\%} - 50) + \text{Halftime} + \text{Anger} + \text{Anxiety}\ (\text{all fixed effects}) + \text{Player}\ (\text{random effect}) + \text{Error} \qquad \text{Eq.}(1)$$

The coefficients of the final LME model (Eq. (1)) are presented in Table 2. Higher performance scores were seen in the home games than in the away games (average difference = +1.8 points on the 10-point scale). The time effect is plotted in Fig. 1.

The performance scores increased at the same rate during the 2 halftimes, resulting in a 2.3-point ($= 50 \times 0.046$) increase. Moreover, a discontinuity between the 1st and the 2nd half was observed resulting in a 2.4-point decrease of performance scores; that is, chronologically, performances increased during the 1st half of the game, then decreased by the same amount at halftime, and finally, increased again at the same rate during the 2nd half (performance evolution: +2.3; −2.4; +2.3) (Fig. 1).

Only 2 emotions (anger and anxiety) were associated with performance, more specifically with a deterioration of performance (anger = −1.79 points; anxiety = −1.05 point).

4. Discussion

Emotions are proposed to have powerful effects on performance and in turn, performance has an even stronger influence on emotions.[5,6] A limitation in previous research has been a tendency to investigate emotions before a competition. The primary purpose of the present study was to examine relationships between emotions and performance in rugby union games, considering pre-performance (and not pre-competitive) emotions. A unique contribution of the present study was that we assessed the emotion−performance relationships within a competition, using a measure of performance that was specific to rugby and had face validity for players and coaches alike.

Emotions are dynamic in nature and influence behaviors. In sport, players' behaviors are directly associated with performance. Thus, the performance discontinuity observed in the current study between the 2 halves of the game may be explained through the scope of emotional influences. Indeed, halftime period is not just a physical recovery period but also one for psychological preparation in relation to the 2nd half.[39] It has been reported that during this period a coach might use routines to try to directly manage players' emotional states,[14] which is considered as an interpersonal emotion regulation.[40] Coaches also speak to their players about the game (e.g., describe a strategic plan)[14] and improving beliefs in being able to complete the task successfully can have effects on emotions. According to the process model of emotion regulation,[41] tactical plans are similar with a strategy of modification situation that may also influence players' emotional states.

Our results indicate a significant effect of emotions on performance. Specifically, it was found that among all emotions experienced by the participants, anger and anxiety only significantly influenced their performances during games. In a recent systematic review on emotions in team-contact sports, it was found that anxiety and anger were the most studied emotions.[4]

Nevertheless, the authors claimed "it is unclear whether they are the most popular emotions investigated, or whether they are central to player performance experiences" (p. 90). In the current study, our results supported the latter suggestion and showed that anger and anxiety were unhelpful to performance in rugby. According to Lazarus,[6] both emotions arise from an evaluation of goal incongruences resulting in negative expectancies about a future outcome. Thus, this could lead players to behave as if there is no possibility to achieve their goals. Therefore, different explanations to this result could be found in literature. It could be argued that both emotions lead to adopt transgressive behaviors resulting in sanctioned faults that damage performance in sports.[42,43] It could be also considered that these unpleasant emotions are associated with negative thoughts,[26,44] which are central to tactical performance.[32,45] Finally, one might assume that the detrimental effects of anxiety could be explained by a deficit in emotion regulation.[46] For instance, to vent their anxiety, players may adopt individualistic ways of playing rather than respecting the collective strategy. For example, if passing the ball to a teammate would be the best strategy for scoring, a player might instead choose to take a risk by trying to score alone to reap the personal benefits (e.g., positive coach assessment or extra pay).

The most valuable contribution of this research to the literature may be its methodological approach. Indeed, addressing some gaps about knowledge on emotion−performance relationships, we employed a qualitative design that allowed studying emotions experienced just before a discrete performance (i.e., pre-performance emotions) in an ecological context. Furthermore, we used a method to assess performance that compared different types of behavior on the same scale and analyzed this relationship by correcting for possible confounding effects between game time and location. Accordingly, it could be assumed that this current finding showed a more representative view of what the influence of emotions was on performance in rugby. Although we acknowledge that this work needs to be repeated with more participants from different team-contact sports such as ice hockey or U.S. football,[4] this research opens potentially new lines of investigation and is promising to re-consider the emotion−performance relationship in sports.

Authors' contributions

MC conceived and carried out the study, and drafted the manuscript; SC performed the statistical analysis and drafted the data analysis and results sections of the manuscript; AML and BL helped to draft the manuscript; ER and CF participated in the design and coordination of the study. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

Competing interests

The authors declare that they have no competing interests.

Appendix

In order to study the time effects on performance, 2 variables were created from the time information:

(1) as match durations were different so were the within-match halftime durations, the time values t were rescaled for each match between 0% and 50% in the 1st halftime (Time% = 50 × (t/FHTD) where FHTD is the 1st halftime duration) and between 50% and 100% for the 2nd halftime (Time% = 50 × (1 + (t-FHTD)/(SHTD)) where SHTD is the 2nd halftime duration)

(2) a binary halftime variable where halftime = 0 (if $t \leq$ FHTD) and halftime = 1 (if $t >$ FHTD).

Interesting time effects can be studied in a linear model (even including other independent measurements) using a special interaction between the Time% and halftime variable: (Time%—50) × halftime.

The resulting model has the form:

$$\text{Performance} = b_0 + b_1 \times (\text{Time} - 50) + b_2 \times \text{Halftime} + b_3 \times (\text{Time} - 50) \times \text{Halftime} + \ldots \quad \text{Eq.(A1)}$$

The 3 parameters b_1, b_2, and b_3 have the following interpretations (Fig. A1):

- b_1 is the slope of the 1st period.
- b_3 describes the difference in slopes between the 2nd period and the 1st one. An interesting linear contrast is $c_1 = b_1 + b_3$ giving the slope in the 2nd period.
- b_2 indicates the discontinuity between the end of the 1st period and the beginning of the 2nd one. Besides, using a 2nd linear contrast: $c_2 = b_2 + 50b_1$, the equality of the mean responses at the beginning of the 2 periods can be tested.

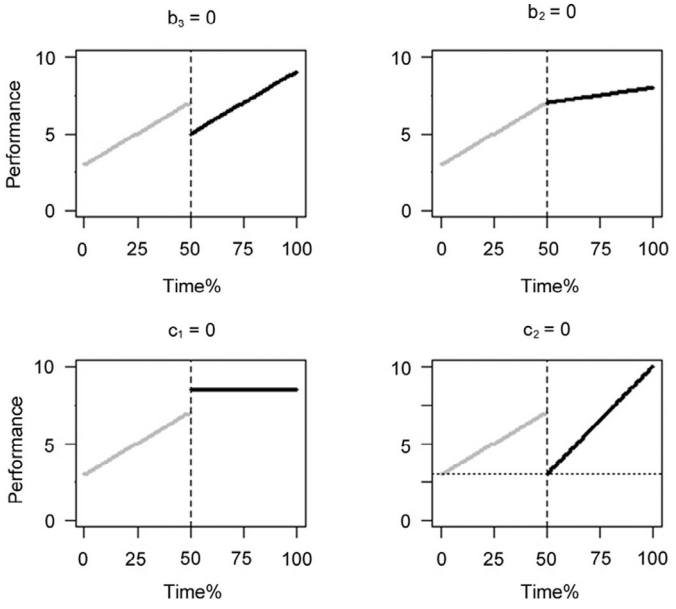

Fig. A1. Some potential situations of time effect and halftime effect on performance using specific values of parameters in Eq. A1 (in the 4 examples $b_0 = 3$ and $b_1 = 0.08$).

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