

Breuer, Christoph; Rumpf, Christopher; Boronczyk, Felix

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Sponsor message processing in live broadcasts—A pilot study on the role of game outcome uncertainty and emotions

Christoph Breuer  | Christopher Rumpf | Felix Boronczyk 

Department of Sport Economics and Sport Management, German Sport University Cologne, Cologne, Germany

Correspondence

Christoph Breuer, Department of Sport Economics and Sport Management, German Sport University, Am Sportpark Müngersdorf 6, 50933 Cologne, Germany.
Email: breuer@dshs-koeln.de

Abstract

Live sport broadcasts can evoke emotions in consumers and allow companies to reach their audience in environments that allow for automatic processing of brand messages. However, only few studies have applied psychophysiological methodologies to assess how the live nature of a competition and viewers' emotions affect the processing of sponsor messages, and prior research has mostly relied on ex-post data. Therefore, to identify the interplay of game outcome uncertainty, viewers' emotions and attention to sponsor messages, this exploratory lab study tracks continuous viewer data during live sport broadcasts. Soccer fans' ($n = 11$) arousal, emotional valence, and visual attention to sponsors while watching live soccer broadcasts were measured using galvanic skin response, video-based facial expressions, and infrared eye-tracking. In-play betting odds served as an indicator of outcome uncertainty. Multi-level modeling reveals that greater outcome uncertainty increases arousal and the magnitude of emotional response. Further, the data reveal that low-to-moderate arousal and valence-neutral emotional states increase viewer attention to sponsor messages. This study is the first to consider the dynamics of live sports experiences in the explanation of sponsorship effectiveness. It contributes to the literature by using continuous measurements involving psychophysiological data to investigate emotions and attention to sponsors.

KEYWORDS

arousal, emotions, eye-tracking, outcome uncertainty, sponsorship, visual attention

1 | INTRODUCTION

1.1 | Background

Sponsorship-linked marketing has become an essential element in brand communication. Among other reasons, it allows drawing consumers' attention to brand information, mostly automatically

and in emotional contexts, which helps to overcome communication barriers in an information-overloaded attention economy. In marketing research, the influence of attention on downstream outcomes has been widely recognized in recent years (Casado-Aranda et al., 2020; Orquin & Wedel, 2020; Romaniuk & Nguyen, 2017). Its growing relevance is based on empirical evidence that attention to a brand facilitates processing, resulting in

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more favorable brand consideration (Pieters & Warlop, 1999), brand preference (Florack et al., 2020), and purchase decision-making (Chandon et al., 2009; Yegoryan et al., 2020).

Research has revealed several drivers of attention to sponsor messages in sports broadcasts. Media exposure variables, such as logo size, or the duration and exclusivity of sponsor brand exposure positively influence TV viewers' attention to sponsor brands (Breuer & Rumpf, 2012). Additionally, context intensity appears to affect the processing of visible brands, with sponsor messages that are visible in more exciting sport environments attracting less visual attention (Rumpf et al., 2015). The sports communication literature further suggests that factors like camera angle, audience noise, and general sports fandom can all influence how viewers of sport broadcasts allocate their cognitive resources, as well as their emotional reactions (e.g., Cummins & Gong, 2017; Cummins et al., 2012; Keene et al., 2017).

Surprisingly little is known about how the emotions that sport viewers experience can influence the processing of sponsor messages visible during sport broadcasts and the attention they capture. This is a crucial shortcoming, as sports spectators often experience strong emotions (Bal et al., 2011; Carrillat et al., 2015; Lee et al., 2019; Pham, 1992), which could have significant implications from a marketing perspective. Especially live broadcasts hold a unique emotional richness, as the uncertainty of the game or race outcome can trigger strong emotional reactions in spectators (Bee & Madrigal, 2012; Carrillat et al., 2015).

1.2 | Emotions and sponsor message processing

According to the dimensional view of emotions, different emotional states can be conceptualized based on variations in two fundamental dimensions, arousal and valence (Posner et al., 2005). While arousal represents a state of psychological and physiological activation that the viewer experiences (Broach et al., 1995), valence is a binary construct that determines the emotional state as either positive or negative. Over the past decades, much research has investigated how arousal and valence influence advertising effectiveness (e.g., Gorn et al., 2001; Shapiro et al., 2002). Meanwhile, a much smaller number of studies explicitly investigate the influence of arousal and emotional valence on viewers' processing of brand messages in sports broadcasts (e.g., Carrillat et al., 2015; Lee et al., 2019; Newell et al., 2001; Pavelchak et al., 1998; Pham, 1992). For example, Newell et al. (2001) and Pavelchak et al. (1988) examine viewers' memory for advertisements shown during the Super Bowl and find that recall is more strongly related to arousal than valence. Based on their analyses, greater arousal reduces viewers' recall of ads embedded in broadcasts that evoke strong emotional reactions.

Importantly, studies on TV ads can only provide limited insights into the processing of sponsor messages because of the indirect nature of sponsorship-linked marketing and the peripheral exposure of sponsor signage embedded in sports broadcasts (Cornwell, 2014). Unlike TV ads, sponsor messages are not the only content that appears on the screen, but they are visible alongside the broadcast's

main content, for example, the sporting action. In such a context, the viewers' main interest is likely to be focused on the central content, whereas sponsor messages that are placed on surrounding signage will be processed as peripheral signals (e.g., Breuer & Rumpf, 2015; Rumpf et al., 2020). Moreover, the amount of information that viewers face during the broadcast of a typical sport event vastly exceeds their cognitive processing capacity. However, only information that has been perceived can be processed and stored in memory (Lardinois & Derbaix, 2001), therefore the capability of a sponsor message to attract viewers' attention is highly relevant to its effectiveness.

Over the past few years, researchers have increasingly acknowledged this indirect nature of sponsor brand exposure and examined how emotions can influence sponsor message processing (e.g., Carrillat et al., 2015; Lee et al., 2019). Recently, an experimental study by Lee et al. (2019) revealed interesting insights into the allocation of sports viewers' attentional resources, more precisely, their processing of in-stadium sponsor signage. The authors draw on the limited capacity model of motivated mediated message processing (LC4MP; Lang, 2000) and manipulate valence and arousal by exposing participants to different recorded game situations from tighter or more lop-sided games with their preferred team either winning or losing. They find that game outcome uncertainty can significantly affect resource allocation, recognition, and recall of sponsor brands, depending on the preferred team's performance. Notably, this study uses heart rate data and operationalizes cognitive resource allocation as cardiac deceleration. Prior research on the effects of sponsorship-linked marketing has strongly relied on self-report measures. Typically, data are collected after respondents have been exposed to sponsor messages, for example, via surveys during or after sports events. Especially in the context of emotional reaction, psychophysiological measures like heart rate or skin conductance could provide valuable insights as they allow acquiring data in real time and with no or little cognitive bias (Potter & Bolls, 2011). However, like most research in this field to date, Lee et al. (2019) employ prerecorded video stimuli, which represents an important limitation because live broadcasts are much more likely to elicit intense emotions in sports fans due to the uncertainty of outcome. Therefore, compared to the secondary use of sport content such as edited highlight clips, live broadcasts allow for a closer inquiry into the importance of suspense for sponsor message processing.

To the authors' best knowledge, Carrillat et al. (2015) is the only study that examines the influence of arousal on sponsor message processing during sports broadcasts in a realistic, live environment. They conduct a field experiment during which participants watch a full hockey match either on-site or on live TV and find that the likelihood of sponsor recall is contingent on the viewing environment, sponsor-event congruence, and the arousal level. Higher arousal results in less accurate sponsor identification, as attention resources appear to be diverted away from the peripheral sponsor messages and toward the event (Carrillat et al., 2015). These results mirror early findings by Pham (1992), who found a negative relationship between arousal and sponsor recognition, but no effect of

valence. Rather than through psychophysiological measures, Carrillat et al. (2015) measure arousal at three points in time during the game and use the mean of these three measurement points as the arousal score for each participant. Carrillat et al. (2015) and Lee et al. (2019) provide important insights; however, directly measuring viewers' visual attention allocation requires the use of eye-tracking (Pieters & Wedel, 2007). Accordingly, Lee et al. (2019) specifically call for studies that employ eye-tracking to investigate the relationship between viewer emotions and attention to sponsor signage in a live environment.

In summary, the above discussion reveals a gap in the literature regarding the complex processing of sponsor messages embedded in live sport settings and highlights the need to perform a study explicitly designed to analyze how game suspense and viewer emotions affect the processing of sponsor messages. This study accounts for the unique emotional richness of live sports broadcasts and uses aggregated data from real-time measurements for multiple meaningful variables such as arousal, valence, or attention to examine the immediate impact of emotional response on the viewer's attention. Meanwhile, analyzing viewers' emotional reactions and attention allocation throughout an entire match could uncover some potentially relevant patterns that may improve our understanding of how and when exactly sports spectators perceive brand stimuli embedded in sports broadcasts. Therefore, this study seeks to contribute to the literature on sponsor message processing by

- (1) investigating the relationship between viewer emotions elicited by an event and attention to sponsor signage, and
- (2) examining sponsor message processing using multiple real-time measurements throughout full live sports broadcasts.

2 | THEORETICAL FRAMEWORK

2.1 | Uncertainty of outcome and viewers' emotional state

The capability of sports events to evoke emotions among spectators has, in part, been ascribed to their dramatic nature (e.g., Knobloch-Westerwick et al., 2009). Especially live competitions are usually characterized by some level of uncertainty of outcome, as they are unscripted, and the exact result cannot be planned or foreseen. Previous research has shown that spectators' enjoyment of a game depends on this uncertainty of the outcome (e.g., Peterson & Raney, 2008). Outcome uncertainty has been widely examined in the sport economics literature to explain, for instance, attendance demand (e.g., Forrest & Simmons, 2002). Meanwhile, it also appears likely that the degree of outcome uncertainty could influence the spectators' emotional reaction during a game. Contexts that are more competitive provide a higher level of outcome uncertainty and build suspense, especially among highly involved spectators, as they anxiously anticipate the eventual outcome. This level of suspense and anticipation increases excitement and

positively correlates with the arousal that spectators experience (Bee & Madrigal, 2012). The degree of outcome uncertainty can change during a game; for example, it diminishes if one team scores to take the lead and time passes, gradually increasing their likelihood of winning and making the outcome more predictable. Therefore, variations in the uncertainty of outcome could result in varying levels of viewer arousal throughout the game. In keeping with the dimensional view of emotions, the level of arousal experienced because of game outcome uncertainty will also result in variations in the magnitude of the emotional reaction. All else equal, closely fought games will result in greater arousal and a stronger emotional reaction. In contrast, lopsided games will elicit a lower level of arousal and a weaker response. This reasoning is summarized in the following hypotheses:

H1a: *Uncertainty of game outcome positively influences arousal experienced by viewers.*

H1b: *Uncertainty of game outcome positively influences the magnitude of emotions experienced by viewers.*

2.2 | Emotional state and attention to sponsor signage

Prior research on sports viewers' attention to sponsor messages has used the spotlight metaphor of attention (LaBerge, 1983) to explain how attention is directed at sponsor signage. According to this concept, an individual's attentional focus resembles a spotlight that shines only on a limited part of the visual field. The amount of information that individuals face far exceeds their cognitive capacity, and the attention mechanism allows selecting a subset of objects for processing. While objects within this attentional spotlight can be processed more efficiently, others are overlooked (Palmer, 2002). However, previous research in cognitive psychology has established that the scope of the attentional spotlight is not static, but it can widen or narrow. Its width and, therefore, the allocation of visual attention toward objects in the visual field in part depends on the emotional state.

Several researchers have argued that arousal plays an essential role in the processing of emotional stimuli (Kensinger, 2004; Mather & Sutherland, 2011; Schimmack & Derryberry, 2005). For example, McConnell and Shore (2011) demonstrate that arousal can influence cognitive processing, independent of an individual's emotional state. Emotional arousal decreases the attentional resources available for information processing, which restricts the attentional focus to the arousal-eliciting stimulus (Kensinger, 2004). As a result, the processing of information central to the source of arousal is enhanced, while attention to peripheral details decreases.

Much of this reasoning builds on Easterbrook's (1959) cue-utilization hypothesis, which states that arousal reduces the number of cues utilized in a given task. According to this rationale, arousal does not uniformly reduce cue utilization, but instead, the use of peripheral cues is limited in favor of more relevant, central ones. In a

similar vein, the Arousal Biased Competition model (Mather & Sutherland, 2011) suggests that arousal directs cognitive processing toward the arousing stimulus, which has a competitive advantage over the less arousing stimuli in the early visual.

In the context of sport event sponsorship, this would suggest that increased arousal elicited by an exciting competition would narrow the attentional scope and, therefore, negatively affect viewer attention to peripheral stimuli like sponsor signage. This assumption is in line with previous findings that suggest greater emotional intensity elicited by a sports broadcast results in lower recall of commercial messages (e.g., Carrillat et al., 2015; Cummins & Berke, 2017; Pavelchak et al., 1988).

Meanwhile, prior research suggests that the valence of the emotional experience can also play a role. The broaden-and-build theory developed by Fredrickson (1998) assumes that positive emotions have a broadening effect on attention. In brief, positive emotions broaden the attentional focus, increase peripheral information processing (Estrada et al., 1997), and enhance semantic processing (Rowe et al., 2007). Conversely, negative emotions narrow the attentional spotlight and thus reduce the ability to process peripheral information (Johnson et al., 2010). Therefore, positive emotional states might enhance sponsorship effectiveness, as attention focuses on peripheral cues, like sponsor messages on perimeter boards, in addition to the focal sporting action.

Although much empirical work has confirmed the importance of valence and arousal, researchers have argued about how exactly they interact to influence cognitive processing (Singh & Sunny, 2017). Overall, it appears plausible that arousal moderates the relationship between valence and the breadth of attentional scope. Positive affective states appear more conducive to a broad attentional focus than neutral or sad moods (Rowe et al., 2007). However, this seems to hold only for moderate arousal, where the magnitude of the emotional response is sufficiently small (McConnell & Shore, 2011). Conversely, high-arousal, positive valence emotional states, but also strongly negative states should lead to a narrowing of the attentional focus (Fernandes et al., 2011; Singh & Sunny, 2017). The "weapon focus" (Loftus, 1979) is a prominent example of the narrowing effect of strongly negative emotional states. In eyewitness research, this phenomenon describes a narrowing of the attentional field during the experience of strongly negative affective states (see Steblay, 1992, for a review). This narrowing leads to a smaller spotlight and more focused visual attention on central objects at the expense of peripheral information.

In the context of sport events, sponsor signage will typically find itself in the periphery of viewers' vision, who will mostly direct their attentional focus at the sporting action (Breuer & Rumpf, 2015). Assuming that low-arousal environments result in a broader attentional scope, they should be associated with greater visual attention to sponsor signage. Considering the broadening influence of positive emotions at low or moderate levels of arousal, especially positive emotional states at low to moderate levels of arousal should result in greater attention to sponsor messages. On the other hand, greater arousal of either negative or positive valence should narrow the

attentional focus, resulting in less visual attention. Based on this reasoning, the following hypothesis is formulated:

H2: *Moderately positive emotional states increase visual attention to sponsor signage while strongly positive or negative emotional states decrease visual attention.*

3 | METHODOLOGY

3.1 | Research design

A lab study explored the relationships between game outcome uncertainty, emotions, and attention. In this pilot study, highly involved fans watched live broadcasts of full international soccer matches during which real sponsor brands were visible on LED boards surrounding the field. The study synchronized data from multiple streams measuring (1) game outcome uncertainty, (2) emotional valence, (3) arousal, and (4) sponsor brand attention in real time. Attention, arousal, and valence were measured through a biometric approach, while real-time betting lines served as an objective indicator of game outcome uncertainty to provide external validation. Appendix A provides an overview of the games (Table SA1), and the variables and measurements employed (Table SA2).

3.2 | Stimulus material

The 2018 soccer World Cup served as the context for this study because it provided clear sponsor visibility and was expected to create intense emotions among soccer fans. As stimuli, each participant watched a live broadcast of an entire game of their favorite national team, which, excluding the half-time break, resulted in a stimulus duration of 90 min per participant.

At the 2018 World Cup, LED perimeter boards presented sponsor messages, which shifted every 30 s throughout the regular playing time in a predefined order. During injury time, all sponsor brands appeared simultaneously, which created a significantly different appearance. Consequently, data collection was limited to the regular playing time (90 min). As national teams did not display any sponsor messages on their jerseys during World Cup games, these messages displayed on LED boards were the only sponsor messages visible in the live broadcasts.

3.3 | Participants

Twelve international students that were enrolled in sport science programs were invited to participate in the study. They were told that the study aimed at measuring the physiological response to live soccer broadcasts and received a compensation of €50. During the recruitment phase, all participants completed a brief questionnaire, which included the nine-item Sport Involvement Inventory

(Beaton et al., 2011) to assess participants' soccer involvement. Further, the Sports Spectator Identification Scale (Wann & Branscombe, 1992) evaluated the participants' level of identification with their favorite national team. To ensure a sufficiently strong emotional reaction, only participants who indicated high involvement and strongly identified with a team were invited and assigned to a game of their favorite national team. Due to problems with accurately tracking the gaze direction, one participant was excluded from the analysis, leading to a final sample size of $n = 11$. All participants provided written consent before the experiment, were treated in accordance with the local institution's ethical guidelines, and reported normal or corrected-to-normal vision.

3.4 | Measurements

3.4.1 | Game outcome uncertainty

Sport economists have used betting odds as a proxy of outcome uncertainty (e.g., Forrest & Simmons, 2002). They reflect factors influencing the game outcome and thus provide information on how tight a game is. The absolute distance between the teams' winning odds ("odds differential") served as a measure of game outcome uncertainty, with smaller deltas indicating higher degrees of outcome uncertainty.

Since in-play odds are updated frequently to incorporate game events as they occur throughout a match, they can reflect dynamic changes in outcome uncertainty and the level of suspense at any given point in time during the game. An algorithm automatically requested the betting data from a leading online bookmaker that additionally provided live information on the score. Further, the data included the minute of play to account for potential time effects of the game progressing on viewer arousal or attention to sponsor messages. The game score was transformed into binary variables that served as additional indicators of game outcome uncertainty.

3.4.2 | Emotional reaction

In this study, the Affectiva Affdex algorithm by iMotions, which is based on the Facial Actions Coding System (Ekman & Friesen, 1978), automatically assessed the participant's facial expressions while watching a live broadcast. Such classification algorithms allow for the visual detection of facial muscle actions to differentiate basic emotions and outperform manual coding in terms of accuracy and efficiency (Teixeira et al., 2012). An external HD-camera was mounted onto a table at a distance of approximately 70 cm to record the participant's face continuously. The algorithm then identified varying configurations of the facial features to classify facial expressions automatically based on a normative database. A valence score was computed based on deviations in two facial landmarks for positive valence (cheek raise, lip corner pull) and deviations in eight landmarks for negative valence (inner brow raise, brow furrow, nose

wrinkle, upper lip raise, lip corner depression, chin raise, lip press, lip suck). The valence score ranged from +100 (max. likelihood of occurrence of defined positive valence facial actions) to -100 (max. likelihood of occurrence of defined negative valence facial actions; Brand & Ulrich, 2019).

Further, as a widely used measure of arousal, participants' galvanic skin response (GSR) data were gathered during the live broadcast. GSR uses temporary increases in electrical conductance of the skin due to increased activity of the sweat glands. Sweat glands are innervated by the sympathetic part of the autonomous nervous system, thus reflecting the current state of arousal. The GSR device sends a small electrical current through the electrodes (placed on the first and second finger) and measures the electrical conductance through the skin. As the sweat glands become more active, the electrical conductance temporarily increases (Dawson et al., 2011). During the broadcast, two finger electrodes of a one-channel device were attached to the participant's middle and ring finger to measure the electrical current. The acquired raw signal was then sent from the device to a computer via a Bluetooth connection. Electrodermal activity varies from person to person (due to skin moisture level, blood pressure, room temperature, etc.). Therefore, a baseline-correction procedure was used, which is akin to the analysis of electroencephalography (EEG) data (e.g., Luck, 2014). First, the individual means of skin conductance were computed and then subtracted from the grand mean across participants. This systematic deviation served as baseline correction and was applied to the raw signal resulting in the baseline-corrected GSR signal.

Next, the variable "magnitude of emotion" was calculated, reflecting the emotional state as determined by the magnitude of arousal and valence on a normalized basis. Following the vector model of emotion (Bradley et al., 1992; Rubin & Talarico, 2009), the variable "emotion vector" was computed, reflecting the dimensional view of emotions. It describes emotional states as vectors that start at zero arousal and neutral valence and point either into a positive or negative valence direction. Positive and negative valences are assumed to be distinct from one another at high arousal, with low arousal states being more likely to be neutral, as true neutrality

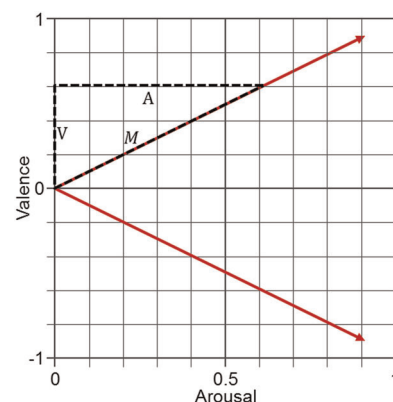


FIGURE 1 Vector model of emotion [Color figure can be viewed at wileyonlinelibrary.com]

cannot be intensely experienced (Remington et al., 2000; Rubin & Talarico, 2009). Figure 1 illustrates the fundamental idea of the vector model of emotions.

3.4.3 | Measure of sponsor brand attention

An infrared eye-tracking device was used to measure participants' visual attention to sponsor messages appearing on a TV screen, which is state of the art in measuring visual attention to brand stimuli (for a review, see Casado-Aranda et al., 2020). The device was connected to a computer running the recording software iViewRED. A 9-point calibration with subsequent validation was performed until both the x and y deviations were below 0.5°. The deviation in measurement accuracy indicated by the SMI handbook amounted to less than 0.4°; therefore, a 42" TV screen served as the stimulus monitor. Larger screens generally improve results; thus the deviation represents a smaller portion of a large display compared to a smaller one.

Data synchronization and analysis were carried out with iMotions screen-based eye-tracking module. All visible sponsor messages on the perimeter boards were detected and marked as areas of interest. By matching the participants' fixations (fixation filter = 100 ms) with these areas of interest in each video frame, the algorithm determined the accumulated duration of fixations on sponsor signage ("glance duration") as a measure of visual attention (Duchowski, 2007).

3.5 | Procedure

The study took place in a quiet room equipped with said TV screen, an armchair and an operator desk. Participants were seated in the

armchair and offered nonalcoholic drinks to increase realism and relax the participants. After briefing the participants about the general procedure, the skin conductance sensor, the HD-camera and the eye-tracker were adjusted, followed by the eye-tracking calibration. Except for the halftime break, participants remained seated over the course of the game.

3.6 | Data analysis

The different data sources varied in the frequency at which they were measured. While "arousal" and "glance duration" were tracked at relatively high frequencies (128 and 60 Hz), the variables "odds differential" and "valence" were measured only once per second (1 Hz), and the sponsor messages presented on the LED boards only shifted every 30 s. Therefore, the original cases were aggregated across these 30-s slots based on the LED board configuration and then the different data sources were merged. In other words, grouped cases were created by pooling data from each time slot. The variables "arousal," "odds differential," and "valence," were mean values representing the average emotional state and uncertainty during a given 30-s slot. Meanwhile, sum values were computed for "glance duration" to measure the attention that each message received. Figure 2 illustrates the data collection and aggregation process.

The final dataset held one case for each participant ($n = 11$) and 30-s time slot (based on the shifting LED board configuration) during the regular playing time (90 min). In other words, the data contained 11 clusters (i.e., participants) with 180 observations each. This longitudinal clustered data structure lends itself to multilevel modeling with random effects to compensate for the violation of the

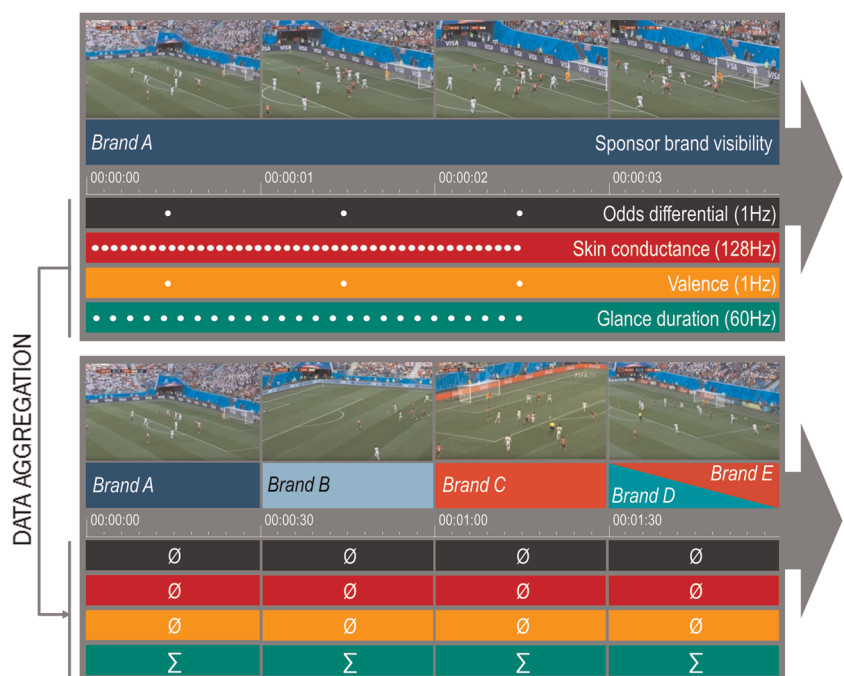


FIGURE 2 Data collection and aggregation
[Color figure can be viewed at
wileyonlinelibrary.com]

independence assumption of traditional regression that occurs when observations are clustered (Laird & Ware, 1982; Orquin & Wedel, 2020). While multilevel models such as GLMM (Generalized Linear Mixed-Model) are typically estimated with maximum likelihood methods, small Level-2 sample sizes (i.e., 11 clusters) can produce inflated Type-I error rates due to downwardly biased estimates of the variance components and the fixed effect standard errors (McNeish, 2017). In these cases, restricted maximum likelihood (REML) estimation should be preferred, which considers the degrees of freedom used for estimating the fixed effects and works well with sample sizes into the single digits (McNeish, 2017). REML does not entirely prevent inflated Type-I error rates for inference about fixed effects, but also using the Kenward-Roger correction (Kenward & Roger, 1997) can achieve nominal Type-I error rates. This approach has been recommended as best practice (e.g., McNeish & Stapleton, 2016), not least because REML estimation with Kenward-Roger adjustment has produced a good performance for studies with ten clusters or even less (Baldwin & Fellingham, 2013; Kowalchuk et al., 2004; Spilke et al., 2005).

Therefore, three GLMMs with REML estimation and Kenward-Roger adjustment were estimated for the dependent variables "arousal," "magnitude of emotion," and "glance duration." The GLMMs for "arousal" and "magnitude of emotion" were estimated with an identity link function based on normal distributions. Following a curve fitting procedure to test for nonlinear relationships, a square root transformation of "odds differential" was carried out. Besides "odds differential^{0.5}," the continuous variable "minute of play" and three bivariate variables reflecting the difference in goals (goal differential = 1, 2, or 3) were entered as fixed effects.

Given the nonnormal distribution of "glance duration" due to a high number of zeros (i.e., no sponsor brand attention), the Poisson distribution with a Log link function was chosen to estimate the impact of game outcome uncertainty and emotions on sponsor brand attention (e.g., Orquin & Wedel, 2020). Based on curve fitting outcomes, the variable "emotion vector" was entered as a linear and as a quadratic term to account for nonlinearity. Moreover, the square root transformed variable "odds differential^{0.5}," the "minute of play" variable and "sponsor brand exposure" served as fixed effects, while the subject variable controlled for random effects. Participant dummy variables served as random effects in all models to control for individual biases. Power analyses using the "ipdpower" command in STATA 16 (Kontopantelis et al., 2016) for all three models confirmed sufficient power of the tests to detect the hypothesized effects. Appendix B provides detailed summaries of the power analyses (Table SB1) and the descriptive statistics (Table SB2).

4 | RESULTS

4.1 | Tests of hypotheses

The three GLMMs estimating the effect of game outcome uncertainty on the sport viewer's arousal and the magnitude of emotion

TABLE 1 Generalized linear mixed-models of arousal

Variable	<i>b</i>	<i>SE</i>	<i>p</i>	95% CI	
				LL	UL
Fixed effects					
Intercept	6.227	0.109	<0.001	5.988	6.465
Odds differential ^{0.5}	-0.076	0.010	<0.001	-0.095	-0.057
Minute of play	0.020	0.001	<0.001	0.018	0.022
Goal differential = 1	-0.718	0.076	<0.001	-0.867	-0.569
Goal differential = 2	-0.720	0.160	<0.001	-1.035	-0.405
Goal differential = 3	-0.076	0.241	0.754	-0.549	0.398
Random effect					
Covariance (subject)	0.108	0.054	0.044	0.041	0.286
Information criterion					
Akaike corrected	5645				
Bayesian	5656				

Note: DV = arousal; *n* = 11 with 1969 observations; probability distribution: normal; link function: identity; testing of fixed effects: Kenward-Roger approximation; Information criteria: -2 log likelihood. Abbreviations: CI, confidence interval; LL, lower level; UL, upper level.

are summarized in Tables 1, 2, and 3. The coefficients displayed in Table 1 reveal that "odds differential^{0.5}" had a significant negative effect (*b* = -0.076; *p* < 0.001) on arousal. This means that arousal was lower during phases where the game outcome was less uncertain,

TABLE 2 Generalized linear mixed-models of magnitude of emotion

Variable	<i>b</i>	<i>SE</i>	<i>p</i>	95% CI	
				LL	UL
Fixed effects					
Intercept	0.559	0.014	<0.001	0.528	0.589
Odds differential ^{0.5}	-0.006	0.001	<0.001	-0.008	-0.004
Minute of play	0.002	<0.001	<0.001	0.001	0.002
Goal differential = 1	-0.067	0.009	<0.001	-0.085	-0.050
Goal differential = 2	-0.083	0.019	<0.001	-0.120	-0.046
Goal differential = 3	0.004	0.028	0.879	-0.051	0.059
Random effect					
Covariance (subject)	0.002	0.001	0.038	0.001	0.005
Information criterion					
Akaike corrected	-2809				
Bayesian	-2798				

Note: DV = magnitude of emotion; *n* = 11 with 1969 observations; probability distribution: normal; link function: identity; testing of fixed effects: Kenward-Roger approximation; Information criteria: -2 log likelihood.

Abbreviations: CI, confidence interval; LL, lower level; UL, upper level.

TABLE 3 Generalized linear mixed-models of sponsor brand attention

Variable	b	SE	p	95% CI	
				LL	UL
Fixed effects					
Intercept	3.808	0.179	<0.001	3.410	4.207
Odds differential ^{0.5}	-0.025	<0.001	<0.001	-0.026	-0.023
Emotion vector	0.165	0.003	<0.001	0.158	0.171
Emotion vector ²	-0.282	0.013	<0.001	-0.308	-0.256
Minute of play	-0.003	<0.001	<0.001	-0.003	-0.003
Sponsor brand exposure	0.064	<0.001	<0.001	0.064	0.065
Random effect					
Covariance (subject)	0.351	0.157	0.025	0.146	0.844
Information criterion					
Akaike corrected	1,603,925				
Bayesian	1,603,931				

Note: DV = glance duration [ms]; *n* = 11 with 1896 observations; probability distribution: Poisson; link function: Log; testing of fixed effects: Kenward-Roger approximation; information criteria: -2 log likelihood.

Abbreviations: CI, confidence interval; LL, lower level; UL, upper level.

which provides support for H1a. Meanwhile, the effect of “minute of play” was significantly positive

($b = 0.020$; $p < 0.001$) which means that the degree of viewer arousal increased throughout a match. Moreover, higher levels of “goal differentials” led to a decrease in arousal, although “goal differential = 3” was insignificant ($b = -0.076$; $p = 0.754$). As would be expected, the random effects standard error ($SE = .054$) and the wide confidence interval ($LL = -0.069$, $UL = -0.001$) point toward considerable variation between subjects. Thus, the effects could be much stronger or weaker, depending on participant and game.

Next, to incorporate emotional valence, the “magnitude of emotion” vector that reflects both the degree of arousal and valence served as the dependent variable with the same set of predictors. The coefficients are summarized in Table 2. The fixed effects of “odds differential^{0.5}” ($b = -0.006$; $p < 0.001$) and “minute of play” ($b = 0.002$; $p < 0.001$) are highly significant, lending credence to H1b. Compared with the arousal model, the information criteria show a higher model fit (Akaike corrected = -2809; Bayesian = -2798).

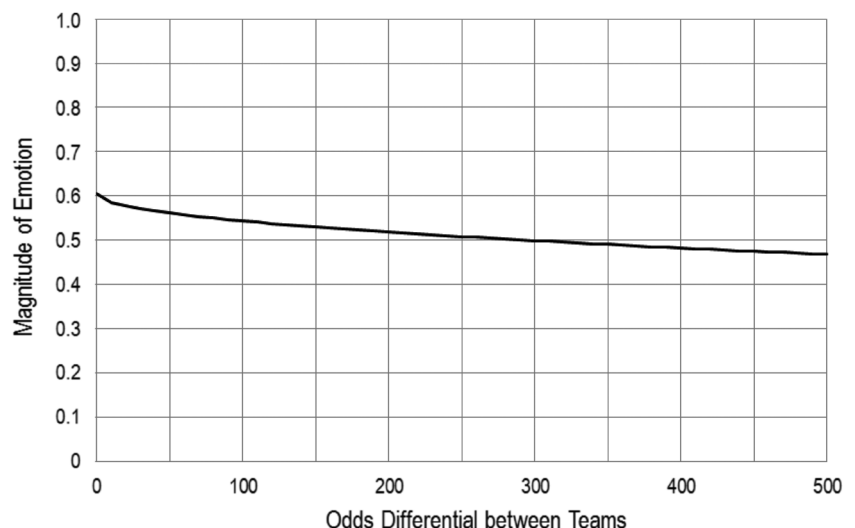
Figure 3 shows the plotted square root curve for the impact of “odds differential^{0.5}” on the “magnitude of emotion”: The higher the difference between the winning odds (indicating lower game outcome uncertainty), the weaker the sport viewers' emotional response. This effect diminished at high levels of “odds differential.”

Concerning the impact of emotions on attention, the GLMM presented in Table 3 provides support for H2. The model outputted a significant inverted U-shaped relationship between the emotion vector and attention to sponsor signage. The curve is displayed in Figure 4. Further, while the “minute of play” coefficient was significantly negative ($b = -0.003$; $p < 0.001$), the variable “sponsor brand exposure” boosted attention to sponsor brands ($b = 0.064$; $p < 0.001$). Finally, “odds differential^{0.5}” showed a significant negative effect ($b = -0.025$; $p < 0.001$) on “glance duration,” which means that lower levels of game outcome uncertainty lead to less attention to sponsor messages.

5 | DISCUSSION

This paper investigates how certainty about game outcome and viewers' emotional experience while watching live sports influence the processing of sponsor messages displayed in live broadcasts. Viewers' emotional reaction to sports broadcasts was analyzed in two ways: (1) As a response to game outcome uncertainty and (2) as a predictor of sponsor brand attention.

Modeling data on in-play betting odds, GSR and facial expressions showed that higher degrees of game outcome uncertainty

**FIGURE 3** Ceteris paribus plot for the effect of “odds differential” on the “magnitude of emotion”

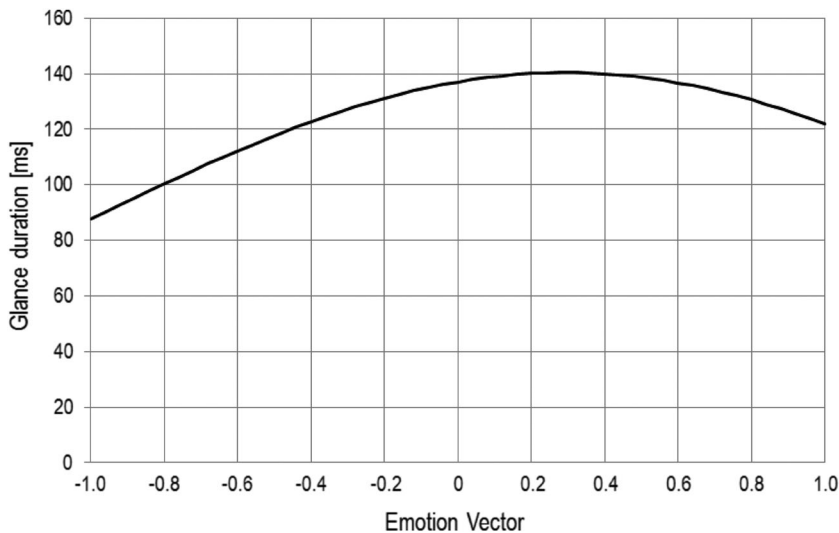


FIGURE 4 Ceteris paribus plot for the effect of “emotion vector” on “glance duration”

increased both viewers' arousal and the magnitude of their emotional response. These observations are in line with H1a and H1b, which postulated positive relationships between game outcome uncertainty, arousal and the magnitude of emotions. Depending on the run of play, sport viewers feel most excited when the game comes close to the end and is still undecided.

Next, the analysis of eye-tracking data using a multilevel model revealed that attention is a function of viewer emotions and game outcome uncertainty. Interestingly, the data showed that higher outcome uncertainty significantly increased attention to sponsor signage when controlling for the emotional state. According to Lee et al. (2019), the LC4MP suggests that fans allocate either less or more cognitive resources toward tight games, depending on their preferred team's performance. Essentially, close games in which the viewers' favorite team is winning leave them with less cognitive resources to spend on the game and vice versa. In this study, most participants watched close games in which their favorite teams lost, which could result in the allocation of more cognitive resources toward the live broadcast, including sponsor signage.

In line with H2, the emotional state as reflected by an emotion vector (Bradley et al., 1992; Rubin & Talarico, 2009) influenced attention to sponsor signage, however, in a curvilinear way. Emotional states of greater arousal had a narrowing effect on the scope of viewer attention, resulting in less attention to sponsor signage as peripheral information placed on the sideline. This observation is in line with Easterbrook's (1959) cue-utilization hypothesis that postulates that greater arousal enhances the processing of central information linked to the source of the arousal, that is, the exciting game. However, the inverted U-shaped effect of the emotion vector on attention observed here also implies that low-to-moderate arousal and neutral-to-positive emotional states are most likely to maximize viewer attention to sponsor messages. This finding can be explained using the broaden-and-build hypothesis (Fredrickson, 1998), which postulates that more positive emotions have a broadening effect on the scope of attention, suggesting that positive valence results in greater attention to peripheral sponsor signage.

This study extends the state of research on sponsorship, brand attention, emotions and improvised marketing interventions (IMIs). (1) Although sponsor signage typically appears in dynamic and suspenseful game situations, sponsorship research mostly relies on studies with static designs or experimental treatments with already known match outcomes. The present study extends this perspective by using an explicitly dynamic design and treatments with unknown outcomes. It thereby answers recent calls for study designs that apply real-time measures and offer greater external validity in sport sponsorship research (e.g., Lee et al., 2019) generates new insights. Additionally, it validated results from studies with more static designs or known outcomes in a more realistic research design. (2) The study also significantly adds to the brand attention literature by emphasizing the dynamic nature of brand stimuli in below-the-line brand communication and the interplay of brand information, run of play, suspense and emotions on brand attention. The study is one of the first to demonstrate that visual attention to sponsor signage is directly affected by game outcome uncertainty and viewers' emotional states. (3) Previous studies on emotions and attention artificially induced emotions before testing attention through showing pictures (Taylor et al., 2017), presenting video clips (Fredrickson & Branigan, 2005) playing classical music (Bruyneel et al., 2013) or giving candy to the participants (Wadlinger & Isaacowitz, 2006). The current study also adds to this emotions literature by using the stimulus material to create emotions, which avoided the critical time gap between the emotional experience and the measurement of attention allocation. Further, in an attempt to account for the dynamics and emotional richness of live sports experiences, this study addresses several limitations of prior studies by combining a continuous psychophysiological approach with a real-time viewing environment and multilevel modeling. Previous research on the relationship between outcome uncertainty and emotions in sports (e.g., Bee & Madrigal, 2012; Knobloch-Westerwick et al., 2009), or the impact of emotions on sponsor message processing (e.g., Carrillat et al., 2015; Pham, 1992) had mostly adopted traditional approaches relying on self-reported (ex-post) measurements. (4) Finally, the

study also contributes to the research on IMIs in indirect marketing contexts. Recently, researchers discussed the potential usefulness of improvised marketing interventions on social media (Borah et al., 2020). The authors describe how a brand's improvised reaction to a specific event at a sport event quickly went viral, and they suggest that proactive and real-time management of the messages that companies embed on social media could increase visibility and firm value. The current study adopts a similar perspective and shows how timing and surrounding events can also affect consumer reactions to sponsor messages through variations in emotional response and attention to messages presented in live sport broadcasts.

5.1 | Practical implications

Understanding the relationship between game outcome uncertainty, emotions, and sponsor message processing offers new opportunities to brands that seek to capture sport viewers' attention. Obviously, neither the degree of game outcome uncertainty itself nor the viewer's emotional state is under the control of marketing managers. However, considering the attention patterns throughout games, managers should not neglect the timing of sponsor message exposure. Rather than valuing sponsor packages based on brand visibility, new pricing schemes could consider in-play betting lines and scores to assess communication efficiency during different game situations.

Against the backdrop of emerging research on IMIs (Borah et al., 2020), established features like LED boards, and new developments like digital overlays in broadcasts could create the opportunity to increase sponsor message efficiency through careful timing and instantaneous adjustments. For example, a dynamic exposure approach could optimize the communication efficiency for top-tier sponsors or even auction the most valuable time slots to the highest bidding sponsor. Notably, the rise of digital overlays could further allow sponsor messages to become more targeted soon. Like personalized ads in social media, the placement of sponsor messages in broadcasts could be linked to personal user data. Given that more sports content is watched via streaming services and that the technique of digital overlays within live broadcasts is already employed in some major leagues, personalized sponsor messages seem to be technically feasible.

Sponsorship-linked marketing provides a popular platform for placing brand messages into emotionally arousing environments. However, brand message processing mechanisms are very similar in the context of in-game advertising or product placement (Cornwell, 2014). Hence, the relevance of this study relates to all forms of indirect marketing communication.

5.2 | Limitations and further research

This exploratory pilot study exposed participants to live broadcasts and employed biometric measures for visual attention and emotional

response. While it offers important insights into the interplay between game outcome uncertainty, viewers' emotional reaction, and attention, some limitations have to be considered that point toward avenues for future studies.

First, the multilevel analysis does not focus primarily on Level-2 factors where $n = 11$ but on Level-1 factors where $k = 1969$ ($k = 1896$ for model 3). However, given the time-consuming and complex data collection process employing live broadcasts, the analysis included fewer participants and games than studies using psychophysiological measurements with brief, prerecorded stimuli might. Nevertheless, future studies should seek to replicate the findings in additional sponsorship contexts and increase their validity by incorporating a larger sample, thus increasing the number of clusters in the multilevel models, which would allow considering Level-2 differences between individuals. Since the regression models revealed significant interindividual effects, future studies should explore the impact of viewer-related variables such as sport involvement, media consumption behavior, or brand preferences. More profound knowledge of interindividual effects can be of particular managerial relevance when it comes to the use of digital overlays as a step towards "personalized" sponsor message communication.

Another limitation relates to the measure of attention, which accumulated the duration of individual fixations based on a filter of 100 ms. This approach is relatively inclusive rather than restrictive and might lead to somewhat optimistic estimates, as it does not consider that longer fixations might indicate an increased level of processing (Boucheix & Lowe, 2010; Rayner, 1998). Future research should conduct a more detailed analysis of attention to sponsor messages based on the duration of individual fixations.

Further, future research should explore additional measures of emotional valence. Facial expression analysis via algorithms seems to achieve greater accuracy for standardized pictures of prototypical facial expressions compared to natural facial expressions (Stöckli et al., 2018). Therefore, facial expression recognition might not reliably measure emotional valence during live broadcasts as the faces of sport fans may not constantly reveal the actual state of emotion. Future research should apply alternative biometric measurement approaches (e.g., electromyography, EMG) to explore the antecedents and consequence of valence in a sport live setting.

Finally, while betting lines as a variable globally reflect the overall run of play, future studies should include further data on match events. With in-play data becoming increasingly available, information on, for example, ball possession and position at a certain point in time could be included as potential predictors of valence and arousal.

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DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ORCID

Christoph Breuer  <https://orcid.org/0000-0001-6536-2246>

Felix Boronczyk  <http://orcid.org/0000-0002-2629-5981>

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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