



Sports fans and innovation: An analysis of football fans' satisfaction with video assistant refereeing through social identity and argumentative theories

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ABSTRACT

Few studies examine the impact of decision-aid technologies in professional sports. Particularly, the literature ignores the perception of football fans. Thus, this study investigates football fans' satisfaction with video assistant refereeing (VAR). It employed an online survey of 320 football fans in 2017 to assess their satisfaction with VAR, level of identification with their favourite team, level of enjoyment from debating match events, and attitude towards decision-aid technologies in sport. Accordingly, there were high levels of trust in the accuracy, effectiveness, and fairness of VAR, and most football fans favoured VAR. However, fans with higher identification with their favourite team were less satisfied with VAR as it seems to hinder the joy in debating match events. This research contributes to a greater understanding of fans' preferences towards technology in sports and the importance of debate for fandom identity.

1. Introduction

Various sports have observed the introduction of decision-aid technologies and their significant effect on fans, players, and referees regarding satisfaction with the sport, the competition atmosphere, and the decision-making correctness (Royce, 2012). A decision-aid technology is 'any electronic device, or collection of devices, currently used to aid or assist [...] official[s] in [...] their officiating duties during a match' (Leveaux, 2009, p. 3). In sports, a referee or an umpire is often blamed for the negative result of a team, receiving condemnation for bias in enforcing rules accurately (Catteeuw et al., 2009). However, the physical and psychological demands referees endure in making game-deciding decisions should be noteworthy (Collins, 2010; Leveaux, 2009; Mascarenhas et al., 2006). However, the rapid development of major sports has made it more challenging for referees to make decisions, affecting teams' performance and finances. In 2001, the first decision-aid technology was introduced: Hawk-Eye. It was a multifarious ball trajectory system, predominantly used in tennis and cricket to aid referee decision-making.

Since then, football (soccer) has progressed towards accepting the

implementation of decision-aid technologies. Catalysing factors include previous controversial incidents, such as Frank Lampard's disallowed goal at the 2010 World Cup, which pressured the Fédération Internationale de Football Association (FIFA) to introduce a decision-aid technology. In 2010, FIFA's International Football Association Board (IFAB) discussed the introduction of goal-line technology (GLT) to determine whether the ball fully crossed the goal line and proposed various tests to measure its accuracy and reliability. It was introduced in 2012 and has since been implemented at major football competitions, such as the Men's World Cup, Premier League, Bundesliga, the Union of European Football Associations (UEFA) Europa League, UEFA Champions League (FIFA, 2012), and Women's World Cup (FIFA, 2019a). The success of GLT has opened the door for introducing further decision-aid technologies, despite strong opposition from Michel Platini, the UEFA president at the time.

Since May 2016, FIFA's Quality Programme run workshops to test the effectiveness of video assistant refereeing (VAR), which employs instant replays to increase fairness in football (FIFA, 2019b). VAR commonly comprises a team stationed in a video operation room that checks and assists on-pitch referee decisions on four game-changing

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incidents: goal decisions, penalty decisions, red card incidents, and mistaken identity occurrences. Using a headset, the principal referee can call on VAR for support, or VAR can also inform the referee that a decision or incident should be reviewed. The referee may decide to review, follow, or ignore VAR suggestion of the incident on video footage. The final decision remains with the referee. September 1, 2016, was a landmark in football history when VAR was used during an international friendly match between Italy and France (FIFA, 2016a). During the 2016–2017 season, the Dutch Eredivisie conducted semi-live tests. Other elite-level leagues, such as the German Bundesliga, Italian Serie A, and the Portuguese Primeira Liga, followed (World Soccer, 2016a, 2016b; IFAB, 2016a, 2016b).

VAR has been used in both Men's and Women's World Cups, and may have already influenced matches and player behaviour, as evidenced in the number of red cards during the previous World Cups in Russia and France in 2018 and 2019, respectively. In the seven Men's World Cups spanning the 1990–2014 period, 10 direct red cards (with a minimum of 7 in 2014) were administered on average, relative to 2 direct red cards at the World Cup in Russia. This observation contrasts with that of Women's football, with two direct red cards on average in the seven World Cups spanning the 2015–1991 period, relative to one in France (52 matches were played in the Women's World Cup relative to 64 in the Men's). This comparison may suggest a different influence of VAR for red card incidents in Women's football relative to Men's.

Professional football is a highly competitive business environment under constant pressure to innovate and induce changes in football organisations (Radaelli et al., 2018). According to Escamilla-Fajardo et al. (2020, p. 2), VAR 'was created and implemented to increase competitiveness in professional competitions'. Hence, football governing bodies aim to increase fairness in football matches and satisfy fans. Indeed, the key stakeholders fans represent directly and indirectly generate resources for the football industry through ticket sales, merchandise revenues, sports broadcasting deals, and sports sponsorship agreements (Sutton et al., 1997). Thus, fan passion for and satisfaction of the football game is of high commercial interest, and VAR is considered a means to raise such interest further, despite not being risk-free (Winand, 2016). Since the 2019–2020 season, Premier League matches have employed VAR technology for all their 380 fixtures (Premier League, 2020). However, given inconsistent decisions, time-consuming and unclear processes underpinning such decisions, and a lack of communication with fans, controversy on its usage quickly emerged (BBC Sport, 2019).

Changes, innovations, and developments in sports affect fans, potentially impacting their satisfaction towards their favourite sports (Brown, 1998). Most of the limited research on the influence of decision-aid technologies in sports employ a philosophical perspective to address the necessity or consequences of the use of technology in sport (Collins, 2019; Collins & Evans, 2008, 2012; Josephson, 2019; Nlandu, 2012; Royce, 2012; Ryall, 2012). Other studies examine referees' perceptions and the level of influence of decision-aid technologies in sports (Jordaan & Surujlal, 2013; Spitz et al., 2018), the influence of technology on match proceedings (Carlos et al., 2019), and the implications of technology on multiple stakeholders (Armenteros et al., 2019). However, except for Winand and Fergusson (2018), who address football supporters' perceptions of GLT, the views of football fans on decision-aid technology remain unheard.

Given the importance of fans' identification with their favourite team in examining their behaviour and expectations, this study employs social identity theory (Turner & Tajfel, 1986) and the Sport Spectator Identification Scale (SSIS) (Wann & Branscombe, 1993) to address and measure the level of fan identification. Furthermore, it employs the Sport Spectator Satisfaction Model (SSSM) (Lleuwen et al., 2002) to identify elements of fans' satisfaction, among which fans' opportunity to debate match situations seems critical, as conceived through argumentative theory (Mercier & Sperber, 2011). By combining theories on fan identification, fan satisfaction, and argumentative opportunities, this study quantitatively analyses fans' VAR satisfaction level.

The study contributes to the literature on identifying football fans with their favourite club and their preferences. In addition to exploring the role of technology and innovation in fans' experience of live matches, this study sheds light on the different expectations fans (might) have towards match experience. While prior studies on football refereeing (e Pina et al., 2018) and innovation (Escamilla-Fajardo et al., 2020) highlight the interest to study VAR implications, references on studies that addressed fans' VAR perceptions were missing. This study is first to discuss fans' debating opportunities, as affected by VAR, using argumentative theory. It contributes insight into social identity theory applied to sports fandom. Finally, it addressed the calls for football governing bodies to consult fans on the technology (BBC Sport, 2019), thus informing relevant stakeholders (e.g. professional sports clubs and leagues) of the impact VAR may have on fans and match atmosphere, inevitably resulting in commercial implications for the industry. The study ultimately sheds light on how fans perceive technology in sport, potentially inducing changes in their appetite for more decision-aid technologies in sport.

2. Literature review

2.1. Social identity theory and football fan identification

According to social identity theory (Turner & Tajfel, 1986), individuals relate to groups to which they identify. Individuals create personal and social identities to become part of a specific social group and gain a sense of belonging. Personal identity describes the sense of being unique from other members of society, whereas social identity involves individuals' awareness of belonging to a certain group (Slater et al., 2014). Thus, individuals create emotional and highly valued connections with their identified group. Social identity theory follows Festinger's (1954) social comparison theory, which states that every individual is driven to compare themselves and be involved with other members of society regarded to be similar or better. This comparison is usually performed with in- and out-group members. In-groups (out-groups) comprise members with whom the individual associates (has no association). In- and out-groups are established through a three-stage process: self-categorisation, self-identification and social comparison (Abrams & Hogg, 1990).

Accordingly, football fans identify themselves with similar members of a football community by attending matches, wearing club colours, and chanting alongside other fans; therefore, social identity theory can be applied to them (Greenwood et al., 2006; Klugman, 2008). A fan is 'an enthusiastic devotee of a sport's consumptive object' (Hunt et al., 1999, p. 440). According to Porat (2015), football fandom, the centrepiece of this study, produces identities, shapes individual lives, and provides opportunities for individuals to acquire a football identity. Further, Giulianotti (2002) argued that 'supporting the club is a lived experience, rooted in a grounded identity [...] reflected in an affectionate relationship to the ground that is regularly revisited' (p. 33). Doyle et al. (2017) identified that fans affiliate with football teams to experience a sense of pride and achievement. Giulianotti (2002) argued that fans have different identities and commitment levels. These individuals have an intimate relationship with the club given their fondness representatives such as star players and managers, nourishing the relationship through a market-based approach. Yoshida et al. (2015) stated that the more identified an individual is, the more likely the individual acts in the club's best interest. Less-identified individuals merely seek their benefits. It coincides with Wakefield and Sloan (1995), where highly identified fans are more open to attending matches even if their team is struggling.

Studies have employed the SSIS to examine differing levels of commitment to a sports club, distinguishing sports fans into three groups per their level of identification with their favourite team: low, moderate, and high (Wann & Branscombe, 1993). Wann and Branscombe (1993) demonstrated the scale using the commitment levels of students of the

University of Kansas towards the men's basketball team. Accordingly, fans with high identification were more invested in the team than fans with low identification. Further, highly identified fans were more knowledgeable about the sport and enjoyed a more positive attitude towards future matches than fans with moderate or low identification. This observation coincides with [Giulianotti's \(2002\)](#) framework, where fans with high identification are more involved in the sport, expressing an emotional interest and solidarity towards their favoured team. Using the SSIS, [Winand and Fergusson \(2018\)](#) studied Scottish football fans, where fans of differing levels of identification may have different expectations of a match. Similarly, [Bernache-Assolant et al. \(2007\)](#) applied the SSIS to French sports fans, discovering that respondents of higher identification are most invested and concerned about their favourite team's successes. The findings accord with the frameworks of [Giulianotti \(2002\)](#) and [Hunt et al. \(1999\)](#), where fans can act differently per their level of identification with a team. The distinction between different levels of fan identification and commitment is essential to understanding their VAR perceptions. Indeed, fans with different levels of identification may perceive VAR differently per their match expectations and how VAR may positively or negatively impact their favourite team. Highly identified fans, with high match expectations, may *a priori* be more concerned about VAR potentially impacting their match experience and favourite team relative to lowly identified fans. Contrarily, highly identified fans, via prior positive experiences, may favour the VAR, seeking game-changing decisions in their favour. Thus, this study addresses the following research question:

RQ1: To what extent is the level of fan identification associated with VAR satisfaction?

2.2. VAR and football fans' satisfaction

[Lleuwen et al. \(2002\)](#) developed the SSSM framework to understand sports spectator satisfaction. The model recognises that spectator satisfaction is closely linked to winning or losing and core service satisfaction. Core services are the outcome and atmosphere of a match. [Lee and Kang \(2015\)](#) stated that core service satisfaction is a critical component for fans in deciding whether to attend a future event. This notion accords with [Wakefield and Sloan \(1995\)](#), who implied that 'every effort should be made to make each sport encounter a positive one [experience] to enhance the probability that spectators will [...] return' (p. 163). Regarding VAR, the technology could have a crucial impact on fans' satisfaction with core services. If VAR stalls or reverses a game-deciding decision, fans may be dissatisfied if the change negatively impacts their team. Meanwhile, if VAR overturns a decision (e.g., cancelling a goal) in the favour of the opposition team, their fans, especially highly identified fans as aforementioned, would rejoice. Thus, VAR could induce an unsatisfactory experience for some fans while inducing an understandably positive experience for others in the opposing team.

Hence, [Uhrich and Benkenstein \(2010\)](#) explained that a goal can impact the satisfaction of core services. Incorrectly awarding or disallowing a goal generates a negative or positive response from fans and an unsatisfactory or satisfactory match experience, as per the SSSM. During the 2010 World Cup, one famous incident was when Frank Lampard's shot against Germany was left unawarded though clearly crossing the line. Although a negative experience for passionate English fans, the debate following the incident was exciting for fans in and outside the stadium ([Fillis & Mackay, 2013; Ryall, 2012](#)). The incident is an example of fans deriving enjoyment from debating controversial decisions. Similarly, football fans often debate a foul in the penalty, a red card, or offside decisions. In 2010, former FIFA President Sepp Blatter noted that debating is a crucial factor of fan satisfaction: 'Fans love to debate any given incident in a game. It is part of the human nature of our sport [football]' ([FIFA, 2010](#)). Nevertheless, it raises the question of whether VAR may hinder the debating component and any remaining element of doubt in the possibility to review each situation 'by the book'.

Argumentative theory can be used to understand fans' reasoning as

individuals convince others in the interactive context and produce arguments that support their beliefs or actions ([Mercier & Sperber, 2011](#)). Per [Mercier and Sperber \(2011\)](#), an asymmetry exists between the production and evaluation of arguments where arguments may be biased by the arguer's opinion, which should be evaluated to distinguish good from bad arguments or information. Moreover, when arguing in a debate situation, individuals neglect to evaluate critically but rather focus on identifying opinionated counterarguments not necessarily based on robust information. Further, individuals can 'reason[...] in an unbiased manner, at least when [...] evaluating arguments rather than producing them and when [...] after the truth rather than trying to win a debate' (p. 72). Argumentative theory helps explain how football fans interact and reason regarding match outcomes and contentious decisions. Given football fans' strong attachment to their team, fans are highly motivated to find arguments supporting or explaining their team's action (not necessarily individual players). Technology in sport may potentially impact fans' argumentative opportunities as it furnishes information that helps individuals evaluate arguments somewhat accurately and, consequently, in a less biased manner. Indeed, VAR allows referees to precisely investigate rule violations.

Assumedly, the more fans identify with their team, the more they enjoy debating and arguing in favour of their team. Since the latter would then discourage debate over potentially favourable contentious decisions, fans would favour VAR less. That is, passionate fans highly identified to their team may less likely favour VAR because it removes the joy they derive from debating controversial decisions. Given VAR's perceived accuracy, what fans argue is less about debatable match situations but more about rules' legitimacy and application. Such arguments on football rules are limited since rules are precisely defined. Hence, two hypotheses emerge:

H1: The level of fan identification is positively associated with enjoying debates.

H2: Enjoyment from debates is negatively associated with VAR satisfaction.

2.3. Fans and decision-aid technology in sports

A significant research gap regards the implementation of decision-aid technologies in sports. [Jordaan and Surujlal \(2013\)](#) argued that 'technology has always played a significant role in improving the experience of players, match officials, and other stakeholders' (p. 249). However, studies raised concerns about how technology influences sport. [Collins and Evans \(2008\)](#) examined Hawk-Eye's impact on tennis and cricket. In tennis, researchers noted how the game overly relies on Hawk-Eye; it is 'the decision-maker rather than the decision-aid' ([Collins & Evans, 2008, p. 297](#)). When a tennis player requests a challenge, Hawk-Eye overrules the umpire's decision and erases any margins for debate ([Mather, 2008](#)). [Ryall \(2012\)](#) noted that by implementing decision-aid technologies, the controversial decision debates are lost. She argued that fans still discuss the Wembley goal in 1966 and the Frank Lampard incident at the 2010 World Cup. Those incorrect decisions provide sport value and high levels of entertainment ([Fillis & Mackay, 2013](#)). Further, referring to the accuracy of decision-aid technology in football, [Ryall \(2012\)](#) highlighted that prior to its implementation, issues were raised regarding the accuracy of GLT. When first tested in 2008, GLT proved erroneous and was perceived as unreliable. Thus, she argued that technology can never be 100% accurate and predicted future issues around its use in football as 'all technologies tolerate a degree of statistical error' ([Ryall, 2012, p. 445](#)).

[Spitz et al. \(2018\)](#) revealed that slow-motion technology in football influences referees to penalise game situations more severely. Accordingly, [Jordaan and Surujlal \(2013\)](#) found that referees favour decision-aid technology because it decreases the pressure on them. [Winand and Fergusson \(2018\)](#) surveyed Scottish football supporters and established that most respondents favoured GLT, believing it to be accurate and used properly by referees. The study demonstrated similar satisfaction levels

towards GLT between levels of fan identification but argued for a difference in expectations between lowly and highly identified fans. The former seemed to be less interested in the match outcome and more concerned about being entertained, for instance, by the process and outcome of the decision-aid technology. Consequently, there may also be a difference between how highly and lowly identified fans perceive decision-aid technology. The emergent research questions can be formulated as follows:

- RQ2: To what extent is the level of fan identification associated with attitude towards decision-aid technology?

Differences in VAR satisfaction may also appear between fans per their nationality or type of league they watch. Koenigstorfer et al. (2010) demonstrated that English fans watching English Premier League perceived stadium atmosphere as a more important factor in defining the league's attractiveness. However, German Bundesliga fans regarded the quality of football as more important (Koenigstorfer et al., 2010). Winand and Fergusson (2018) highlighted football fan concerns that the match-day atmosphere may deteriorate, and opportunities for debating controversial decisions would reduce with further decision-aid technology developments in sports, thereby putting the related findings into perspective. Per Winand and Fergusson's (2018) study on GLT, football fans may show similar beliefs in the accuracy and reliability of VAR. However, these two technologies are different and impact the game quite differently: GLT is associated with supposedly immediate outcomes and very brief time delays, if any, while VAR has longer breaks. Consequently, fans with a positive attitude towards decision-aid technologies would support the implementation of VAR, as per Winand and Fergusson (2018). Thus, the third hypothesis is formulated as follows:

H3: Attitude towards decision-aid technology is positively associated with VAR satisfaction.

2.4. Stadium atmosphere and VAR satisfaction

The stadium atmosphere is also regarded as a core service, as per the SSSM. Uhrich and Benkenstein (2010) defined a sports stadium atmosphere 'as the relationship between perceptions of the specific environmental features of a sport stadium and the elicited affective responses of the spectators' (p. 215). Researchers proposed that decision-aid technology, especially instant replay, interrupts the stadium atmosphere and the game's flow (Bordner, 2015; Nafziger, 2004; Svantesson, 2014). This notion is demonstrated by Carlos et al. (2019), who showed an increase in the length of matches, mainly during the first half, when VAR is implemented. Researchers argued that using decision-aid technology in sport 'dehumanises' the game; that is, a certain degree of human error is a part of football (Nafziger, 2004; Svantesson, 2014). Thus, interruptions could negatively impact fans' satisfaction by dampening the stadium atmosphere and, thus, experience (Cairns, 2015). Bordner (2015) also noted that increased instant-replay interruptions could increase the risk of players getting injured, potentially hindering teams from performing their best and ultimately disappointing fans. Hence, Kolbinger et al. (2015) suggested that interrupting the game for instant replays should only be for up to 15 s to avoid extensive game time and an impatient atmosphere.

The impacts of VAR on stadium atmosphere remain unexplored. However, a friendly match between France and Spain in March 2017 provides some indications. Fans were left frustrated when the game stalled for 40 s for an offside call review, which led to a goal for Spain. During the same match, a French goal was correctly invalidated as offside only after players and fans celebrated, resulting in more frustration for French fans. Despite the correct decisions, this incident demonstrated how VAR can impact stadium atmosphere (BBC Sport, 2017). VAR has made several game-changer decisions and annulled goals since its introduction; fans may now cautiously celebrate goals and wait for the final decision from VAR officials and referees, delaying or

partially removing instant celebration excitement. Hence, fans who enjoy a vibrant atmosphere are more likely to oppose VAR. The final hypothesis, thus, follows:

H4: Fan identification, enjoyment from debates (negatively) and attitude towards decision-aid technology (positively) predict VAR satisfaction.

Fig. 1 presents the model predicting VAR satisfaction with the three main dependent variables in this study, as considered H4.

3. Method

3.1. Research design and sample

An online questionnaire (see Appendix A) using the Bristol Online Survey Tool was created in English and translated into German by a native speaker to explore potential differences between German and British fans and explain VAR satisfaction levels. The survey was distributed between February 4 and March 4, 2017, on German and British football fan forums, with multiple posts and reminders to gain more participants and increase the response rate. Moreover, a second data collection phase was undertaken between October 7 and November 25, 2017, to eliminate the nonresponse error threat on the study's external validity, following Jordan et al.'s (2011) technique by comparing early and late respondents.

During the data collection, VAR tests were already underway prior to the second phase of data collection. The technology was used in the 2016 FIFA Club World Cup. It was also tested in the 2016–2017 season of the Dutch Eredivisie and selected matches in the Major League Soccer in the United States and Canada. Further, it was used at the 2017 Confederations Cup in Russia (BBC Sport, 2017). Thus, respondents were poised to have sufficient awareness of the situation. A total of 320 respondents completed the survey, with 244 responding during the first phase and 76, the second phase, which satisfied the recommended criterion of a minimum of 30 useable responses to verify the nonresponse error threat (Lindner et al., 2001).

3.2. Instruments

The study collected demographic information, such as age, gender, number of years of supporting their team and how often per season they watch their team at the stadium. Four scales were used to assess (1) the identification of fans to their club, (2) their satisfaction towards VAR, (3) views on debating in football and (4) attitude towards decision-aid technology in sports. The first scale was Wann and Branscombe's (1993) SSIS to measure the level of identification of football fans by rating their level of agreement on six items. Example items include 'I enjoy it when somebody praises my favourite team' and 'I enjoy watching and supporting my favourite team at the stadium'. The second scale was the satisfaction levels of football fans towards VAR, evaluated

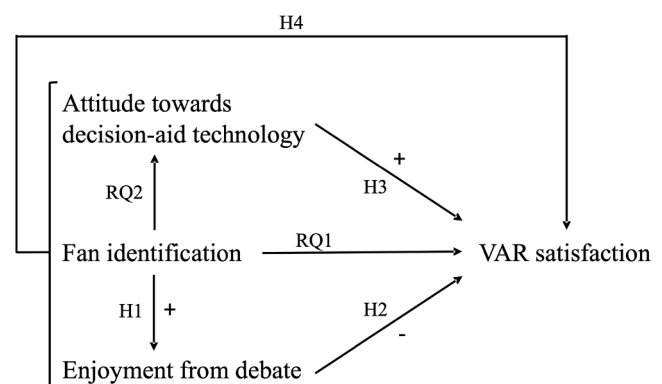


Fig. 1. A model predicting VAR satisfaction.

on six items adapted from the SSSM (Lleuwen et al., 2002). Example items include 'I would like VAR to be used in major football competitions' and 'VAR has satisfied me'. Other scales determined the perceptions of football fans regarding their enjoyment of debates (six items) (e.g. 'I enjoy debating whether a goal was awarded correctly') and their satisfaction with decision-aid technologies in sports (4 items) (e.g. 'I am satisfied with decision-aid technology being used in sport'). Each item was measured via a seven-point Likert Scale, from 1 (Strongly Disagree) to 7 (Strongly Agree), with 4 being Neither Disagree nor Agree. Additionally, respondents answered yes, no, or do not know to questions and statements such as 'Are you in favour of VAR?', 'VAR provides more fairness in football', and 'I trust VAR to function accurately'. Those questions enabled clear and direct responses from participants on how they perceive VAR.

3.3. Statistical analysis

Factor analysis and Cronbach's Alpha (>0.7) were computed with the IBM SPSS 23.0 software to estimate the reliability of the scales. Principal component analysis (factor loadings > 0.4), verified by Cronbach's Alpha ($p > .7$), was then employed to calculate the reliability of the scales for fan identification, VAR satisfaction, enjoyment from debate, and attitude towards decision-aid technology in sports. The average scores of items were calculated to obtain a score for each scale. Further, correlation analysis was conducted to ascertain whether scales were significantly correlated. Finally, the study ran a multiple linear regression to explain the respondents' VAR satisfaction levels.

4. Results

4.1. Descriptive statistics

First and second stage respondents showed no respective difference for fan identification, VAR satisfaction, enjoyment from debate, and attitude towards decision-aid technology in sports, potentially reducing

Table 1
Profile of the respondents (N = 320).

	Frequency (n)	Percent (%)
<i>Nationality</i>		
British	185	57.8
German	120	37.5
Others	15	4.7
<i>Gender</i>		
Men	223	69.7
Women	97	30.3
<i>Age</i>		
18–25	132	41.3
26–33	39	12.2
34–41	44	13.8
42–49	37	11.6
50–57	30	9.4
58–65	30	9.4
66+	8	2.5
<i>Years supporting team</i>		
5 or below	19	5.9
6–10	34	10.6
11–15	65	20.3
16–20	72	22.5
21–25	59	18.4
26–30	18	5.6
31+	53	16.6
<i>Frequency of stadium attendance per season</i>		
None or under 5	145	45.3
6–10	60	18.8
11–15	39	12.2
16–20	25	7.8
21–25	11	3.4
26–30	18	5.6
31+	22	6.9

nonresponse bias. As defined in Section 3.2, Table 1 shows the demographic characteristics of the sample, among which 57.8% were British, 37.5% were German, and 4.7% other nationalities. Most of the respondents were men at 69.7%. Women followed at 30.3%. Those below the age of 33 were 53%; 25.3% were between 34 and 49, and 21.3%, over 50.

4.2. VAR satisfaction and related variables

Table 2 shows fans' VAR perceptions, where 67.2% favoured VAR, 22.5% were against it, and 10.3% did not know. Further, 70% trusted referees to use VAR effectively, and 78.4% believed VAR function accurately during football matches. Moreover, 87% thought VAR provides more fairness to football. Respondents showed differing opinions in their VAR satisfaction: 44.4% were satisfied with VAR, 34.3% were unsure, and 21.3% were dissatisfied.

Table 3 presents the factor analyses and the Cronbach's Alpha of the scales employed, as defined in Section 3.2. All factor loadings of the four scales exceeded 0.4, and Cronbach's Alpha for the different scales scored higher than 0.7, indicating good scale reliability. On average, respondents were relatively satisfied with VAR ($M = 4.36$; $SD = 1.45$). They seemed to enjoy debating contentious football events ($M = 4.82$; $SD = 1.19$) and exhibited a strong positive attitude towards future decision-aid technologies ($M = 5.58$; $SD = 0.94$).

The study employed correlation analysis to evaluate the relationship between variables (Table 4). The correlations between fan identification and satisfaction with VAR ($r = -0.35$) and attitude towards decision-aid technology in sports ($r = -0.17$) were negative and significant, corresponding to RQ1 and RQ2, respectively. Fan identification positively correlates with enjoyment from debate ($r = 0.43$), confirming H1. The more participants identify with their favourite team, the less satisfied they are with VAR, the less they favour decision-aid technology in sports, and the more they enjoy debating. The correlation between attitude towards decision-aid technology and satisfaction with VAR ($r = 0.62$) is positive and significant, confirming H3. Enjoyment from debate is negatively correlated with VAR satisfaction ($r = -0.64$) (confirming H2) and attitude towards decision-aid technology ($r = -0.33$).

Table 5 presents the multiple linear regression results, which predicts VAR satisfaction levels. Control variables include age, gender, nationality, number of years supporting a team, and frequency of attending a match at a stadium to watch favourite teams play. Fan identification, enjoyment from debate, and decision-aid technology explain the fan perceptions towards VAR. The fifth model in Table 5 predicts 65% of the variance in fan satisfaction with VAR through gender ($\beta = 0.41$; $p < .001$), nationality ($\beta = 0.53$; $p < .001$), fan identification ($\beta = -0.18$; $p < .01$), enjoyment from debate ($\beta = -0.52$; $p < .001$) and decision-aid technology ($\beta = 0.72$; $p < .001$).

Therefore, the more fans identify with their team, the less satisfied they are with VAR. Moreover, the more they enjoy debating, the less satisfied they are with VAR. Furthermore, the more they favour decision-aid technology in sports, the more satisfied they are with VAR. Hence, H4 is confirmed.

Table 2
Fans' perceptions (%) on video assistant refereeing (VAR) (N = 320).

	Yes	No	DNK
In favour of VAR?	67.2	22.5	10.3
Satisfied with VAR?	44.4	21.3	34.3
Trust VAR to function accurately?	78.4	5.9	15.7
Trust referees to use VAR effectively?	70.3	11.3	18.4
VAR provides more fairness in football?	87.5	5.3	7.2

Note: DNK = Did not know

Table 3

Scales of fan identification, VAR satisfaction, enjoyment from debate and attitude towards decision-aid technology (N = 320).

	Factor Loadings	Cronbach's Alpha	Mean	SD
S1—Fan identification		0.76	5.45	0.91
I believe I have a strong emotional relationship with my favoured club.	0.85			
The football team's successes are my successes.	0.73			
I enjoy watching and supporting my favourite team at the stadium.	0.66			
I enjoy it when somebody praises my favourite team.	0.64			
I do not enjoy it when my favourite team is criticised.	0.63			
I dislike my favourite team's rivals.	0.59			
S2—VAR satisfaction		0.91	4.36	1.45
Video assistant refereeing interrupts the flow of the game. (inversed)	0.80			
Video assistant refereeing increases stadium atmosphere.	0.76			
I would like VAR to be used in major football competitions.	0.75			
I am in favour of referees requesting instant replays.	0.75			
The use of video referees enhances the atmosphere at a football match.	0.72			
VAR has satisfied me.	0.67			
S3—Enjoyment from debate		0.89	4.82	1.19
I enjoy debating whether a red card incident has a crucial influence on the outcome of a game.	0.89			
I enjoy debating whether a foul was awarded correctly.	0.84			
I enjoy debating about wrong refereeing decisions.	0.84			
I enjoy debating whether a goal was awarded correctly.	0.83			
A contentious goal being awarded improves the atmosphere at a football match.	0.48			
Without human error, a football match is less interesting.	0.47			
S4—Decision-aid technology in sports		0.76	5.58	0.94
Decision-aid technology produces a fair result.	0.83			
Decision-aid technology is more accurate than human judgement.	0.78			
Instant replay assists referees to make correct decisions.	0.72			
I am satisfied with decision-aid technology being used in sport (e.g. GLT; Hawk-Eye).	0.52			

Note: Extraction Method: Principal Component Analysis (PCA)
 47.5% of the variance is explained for S1—Fan identification.
 68.4% of the variance is explained for S2–S4 with Rotation Method: Varimax with Kaiser Normalisation (Rotation converged in six iterations)

Table 4

Correlation analysis between variables (N = 320).

	S1	S2	S3	S4
S1 - Fan identification	–			
S2 - VAR satisfaction	-0.35***	–		
S3 - Enjoyment from debate	0.43***	-0.64**	–	
S4 - Decision-aid technology in sport	-0.17**	0.62**	-0.33**	–

Note: ** $p < .01$; *** $p < .001$

5. Discussion

Most fans favoured VAR and believed VAR functions accurately, provides more fairness to football, and referees can be trusted to use it. These results accord with FIFA President Gianni Infantino, who stated that VAR enables referees “to take the right and just decision” (FIFA, 2016b). However, half the fans were dissatisfied or unsure what to think about VAR, as reflected in the scale assessment of VAR that shows a nearly neutral value ($M = 4.36$). Thus, despite recognising the positive impact of VAR, fans are not entirely satisfied with it. The higher the fan identification, the more they disliked VAR. The findings do not accord with Winand and Fergusson (2018), who did not find differences between fan identification and their satisfaction with GLT. GLT and VAR's different technologies may explain the discrepancy: GLT instantly reviews whether balls crossed the goal line, while VAR reviews other sensitive aspects of the games, such as offside, fouls, or penalties, which require interpretation and longer delays.

The more fans identified with their club, the more they enjoyed debating contention decisions. According to Porat (2015), football fandom shapes individuals' lives and provides opportunities for individuals to share a common identity. Fans like to engage in extensive debates after an incident has occurred and derive enjoyment from controversial incidents during a match (Fillis & Mackay, 2013; Ryall, 2012). However, fans who identify less with their football club do not share the same passion towards debate as fans who identify more strongly with their football club. For the latter, VAR may curb the debate and excitement from watching football matches, which relate them to other fans, contributing to building their football identity. Per the social identity theory (Turner & Tajfel, 1986), debates seem to contribute to or explain the level of fan identification with a team as a social element that links fans together.

The introduction of VAR, however, may have changed the way fans debate. VAR has certainly not removed all football contentions and debates but has, nonetheless, impacted match debates and atmosphere, as suggested by Bordner (2015) and Svantesson (2014). This change seems to affect fans who strongly identify with their favourite team negatively. The study findings can be interpreted from the argumentative theory perspective (Mercier & Sperber, 2011). The more fans identify with their team, the higher the need to argue in favour of their team, supporting their own belief that, for instance, their team deserves to win or is a victim of unfairness. Any unfavourable contention is an opportunity for debate with peers within the same social group and against fans of an opposing team.

However, arguments by fans with a stronger identity with their team may be biased because such identity skews their opinions and belief. Accordingly, VAR technology furnishes more robust information that allows individuals to evaluate a situation with less personal interpretation. Thus, it shifts the debate to the legitimacy or application of rules, further confirming that VAR does not negate debate entirely. Indeed, this study suggests VAR technology hinders fans' argumentative opportunities by providing information that helps individuals evaluate arguments somewhat accurately and in a less biased way. That is, passionate fans, highly identified with their team are less likely to favour VAR because it partially removes the enjoyment they derive from debating controversial decisions.

Multiple linear regression analyses provided further insights into what elements influence VAR satisfaction levels. The results indicate that nationality partly explained dissatisfaction towards VAR. Per Koenigstorfer et al. (2010), German fans regard football quality as more important, which may explain why they favour VAR less than British fans. Although the sample size of this study does not permit generalisation over the population of German and British fans, German fans may perceive and attach more importance to VAR, hindering football flow and quality. Gender also explained the VAR satisfaction levels. While further data would be required, male and female fans expressed different views on VAR. Women were more satisfied with VAR than men.

Table 5

Multiple regression (n = 320) predicting football fans' satisfaction towards VAR from identification, debate and decision-aid technology.

Predictor variables	Model 1	Model 2	Model 3	Model 4	Model 5
Age18 – 35 years>35 years	0.26	0.35*	0.24	0.24	0.15
GenderMenWomen	0.42*	0.34*	0.28	0.27*	0.41***
NationalityGermanOther nationalities (British, and other)	0.87***	0.80***	0.86***	0.63***	0.53***
Years supporting team0–10 years>10 years		-0.13	0.17	0.19	0.19
Frequency of stadium attendance0: < 5 matches/season1: ≥ 5 matches/season		-0.56**	-0.21	-0.10	0.17
Fan identification			-0.53***	-0.17*	-0.18**
Enjoyment from debate				-0.69***	-0.52***
Decision-aid technology in sport					0.72***
R ²	0.10	0.14	0.22	0.47	0.65
R ² change	0.10	0.04	0.08	0.25	0.18
Significance of F Change	<0.001	<0.001	<0.001	<0.001	<0.001

Note: * p < .05; ** p < .01; *** p < .001

Women may be less concerned about how VAR may negatively impact the game and appreciate the value VAR brings to the game more than men.

Logically, attitude towards decision-aid technology supports VAR satisfaction with fans favouring such technology welcoming further introduction. However, fan identification levels exhibited slight differences in attitudes towards decision-aid technology, with highly identified fans less supportive of the new technology than less-identified fans. Hence, decision-aid technology may satisfy highly identified fans less than less-identified fans. [Giulianotti \(2002\)](#), [Hunt et al. \(1999\)](#), and [Winand and Fergusson \(2018\)](#) note that fans with a low affinity to their club are more interested in being entertained than the result of the match. Accordingly, the SSSM ([Lleuwen et al., 2002](#)) proposed that fans with different commitments have alternative expectations of a match, and certain components of a match are less or more influential per their satisfaction level. The study findings accord with [Ryall \(2012\)](#) that implementing decision-aid technology reduces the element of contention in football. Those who enjoy debating football more likely believe contention is a significant experiential component and oppose its elimination.

Hence, contentious events in sports arguably contribute to the stadium atmosphere, as suggested directly by [Winand \(2016\)](#) and indirectly by [Fillis and Mackay \(2013\)](#) and [Ryall \(2012\)](#). It is crucial for fan satisfaction, contributing to the overall match experience and attractiveness ([Biscaia et al., 2010](#)). Thus, while decision-aid technology curbs (or shifts) the debate, it may reduce or shift spectator response, thereby affecting stadium atmosphere and fan satisfaction, especially regarding highly identified fans who enjoy debates and dislike VAR.

5.1. Limitations and research implications

Using an online questionnaire and forum posts to invite participants may have influenced the study findings, as younger individuals would be more inclined to interact on social media. Accordingly, this study has a high proportion of respondents below 25 years old (41.3%). However, younger (18 to 33) and older (34 or over) age groups exhibited no significant differences for the key variables of the study, supporting the validity of the results across fans of different age groups. Another limitation regards the participant sample: fans on forums are more likely to show higher identification with their favourite team than those not on any forum. This situation might explain the small number of fans with low identification, potentially influencing the VAR satisfaction findings, which, per the results, may have been under-valued.

An in-depth investigation of supporters who visit the stadium might contribute interesting insights, as they may strongly support VAR and expect a different experience at matches relative to fans with a high identification with their team. Such a study would be novel given the

plethora of research focusing mainly on moderately and highly identified fans. Meanwhile, research using argumentative theory in sports management for analysing passionate fandom is of high interest to further understand fan's reaction to change of rules and match events.

Notably, VAR tests were underway during the data collection. However, the technology was yet to be fully implemented in major national competitions. Thus, further studies could investigate the longitudinal perceptions of football fans regarding VAR once it is ubiquitous and globally established in most national and international competitions. Moreover, it could be worthwhile to investigate fan perceptions and satisfaction at matches with and without VAR interventions while gauging match atmosphere and enjoyment from debating match events. Instant replays across sports could be examined along the same line, particularly when comparing the use of decision-aid technology among sports where decision-making via instant replays seems faster and more transparently communicated through loudspeakers and screens.

The views of referees could also be considered to understand how VAR impacts their performance and whether they deem the technology useful. Assumedly, VAR relieves referees of much decision-making pressure, especially regarding match-deciding decisions. Further, as the name suggests, VAR assists referees. However, it may limit their authority. Hence, future studies could investigate whether referees' VAR satisfaction levels and the reasons thereof.

This study suggests that VAR shifts the debate of contentious football events from arguments about referees' instant decisions without VAR to arguments about referee's application of the rules with VAR assistance. Thus, a broad research consideration could address whether decision-aid technology makes sports more theoretical, thereby removing the human element, as suggested by [Nafziger \(2004\)](#) and [Svantesson \(2014\)](#). Another could examine the extent to which the spirit of the game is affected. While we acknowledge that decision-aid technology contributes to ensuring compliance with fair-play rules, hence preserving fairness in referee decisions, as [Collins \(2010\)](#) argues, fair play is different from accuracy. Whether fans prefer fair play over accuracy could be another avenue for research. Thus, we call for more research on how VAR impacts football stakeholders, particularly fans.

5.2. Practical implications

This study provides useful implications for FIFA, national football governing bodies, and administrators of sports leagues. FIFA must consider stakeholder opinions, especially fans, before implementing rules that may impact fan satisfaction and match atmosphere, such as VAR. FIFA President, Gianni Infantino, stated that "football without fans is nothing" ([FIFA, 2016b](#), p.1), illustrating the necessity to understand VAR's impact on fan satisfaction. The match between France and Spain in March 2017 demonstrated that changing decisions after players and

fans have celebrated increases fan frustration. Thus, FIFA should consider the views of fans to keep a vibrant stadium atmosphere, which is crucial to fan satisfaction, especially given the potential that decision-aid technologies could negatively affect fan attendance at matches. Moreover, although this study demonstrates that fans generally welcome the technology, given the potential to alienate fans, football governing bodies must carefully consider whether stadium atmosphere, debate, and satisfied fans are worth sacrificing to decision accuracy.

Ultimately, this study informs sport governing bodies that employ referee-supporting technology. Rather than warning against decision-aid technologies, it posits the practicality of considering fan views and cultivating fan debate, as it is essential to fandom identity.

6. Conclusion

This study is first to investigate football fans' VAR perceptions. It suggests differences in fan identification levels, where fans who strongly identify with their favourite team experience less VAR satisfaction. It is also first to apply argumentative theory to sports to demonstrate the importance of debate for football fans. Combining it with social identity theory and SSSM allows for unveiling fans' thought processes in debate situations.

Social identity theory partly explains the passion sports fans may demonstrate towards a team. Their level of identification with their favourite team relates to their expectations and behaviour. For instance, sports fans with high identification to their team gain satisfaction in debating contentious match events more than those with low

identification. The argumentative theory posits that sports fans passionately argue (even if unsound) to support their team's (thus, their own) interest. Sports fans that are highly (lowly) identified with a team argue more (less) passionately in favour of their team during contentious match events.

This study demonstrates that decision-aid technology negatively affects sports fans who identify closely with their team because it limits their opportunities to argue for why their team may have been treated unfairly in certain match situations. Specifically, VAR contributes to supporting accurate decisions 'by the book'. However, this study shows that VAR alters the debating component of football as perceived by football fans, which is crucial to fandom identification and the match atmosphere. Thus, applying social identity theory to sports fandom, debating is an important social phenomenon among sports fans and may strengthen fans' relationships and identification. This study also identified technology as particularly appreciated by football fans with no strong attachment to a team. Such fans may seek a different experience from a match, such as entertainment, which VAR seems to contribute, relative to highly identified football fans who may be more interested in the match outcome.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. —Survey

1. Demographics

How old are you?

18–25	26–33	34–41	42–49	50–57	58–65	66 or more
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Please state your gender

Male	Female
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What is your nationality?

German	British	Other (please write)
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How long have you supported your favourite club?

1–5	6–10	11–15	16–20	21–25	26–30	31 or more
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How often during a season do you watch your favourite team at a football stadium?

0–5	6–10	11–15	16–20	21–25	26–30	31 or more
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2. Scale to assess fan identification

To what extent do you agree with the following statements concerning your favourite football team?

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Disagree nor Agree	Somewhat Agree	Agree	Strongly Agree
I do not enjoy it when my favourite team is criticised.							
I enjoy it when somebody praises my favourite team.							

(continued on next page)

(continued)

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Disagree nor Agree	Somewhat Agree	Agree	Strongly Agree
I believe that I have a strong emotional relationship with my favoured club.							
The football team's successes are my successes.							
I enjoy watching and supporting my favourite team at the stadium.							
I dislike my favourite team's rivals.							

3. Scale to assess satisfaction with VAR

To what extent do you agree with the following statements concerning VAR?

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Disagree nor Agree	Somewhat Agree	Agree	Strongly Agree
Video assistant refereeing interrupts the flow of the game.							
VAR has satisfied me.							
I would like VAR to be used in major football competitions.							
Video assistant refereeing increases stadium atmosphere.							
The use of video referees enhances the atmosphere at a football match.							
I am in favour of referees requesting instant replays.							

Are you in favour of video assistant refereeing in football?

Yes	No	Do not know
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I am satisfied with the use of video assistant refereeing.

Yes	No	Do not know
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I trust video assistant refereeing to function accurately.

Yes	No	Do not know
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I trust referees to use video assistant refereeing effectively.

Yes	No	Do not know
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Video assistant refereeing provides more fairness in football.

Yes	No	Do not know
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4. Scale to assess enjoyment from debating in football

To what extent do you agree with the following statements?

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Disagree nor Agree	Somewhat Agree	Agree	Strongly Agree
I enjoy debating whether a foul was awarded correctly.							
I enjoy debating whether a goal was awarded correctly.							
Without human error, a football match is less interesting.							
A contentious goal being awarded improves the atmosphere at a football match.							
I enjoy debating about wrong refereeing decisions.							
I enjoy debating whether a red card incident has a crucial influence on the outcome of a game.							

5. Scale to assess attitude towards future decision-aid technology

To what extent do you agree with the following statements?

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Disagree nor Agree	Somewhat Agree	Agree	Strongly Agree
Decision-aid technology produces a fair result.							
Decision-aid technology is more accurate than human judgement.							
Instant replay assists the referee to make correct decisions.							
I am satisfied with decision-aid technology being used in sport (e.g. GLT; Hawk-Eye).							

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