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From spectator to segment: a necessary and configurational analysis of Formula 1's marketing adaptation to female fan emotional behavior

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BUSINESS SCHOOL

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Resumo

Este estudo analisa como elementos emocionais e informacionais moldam o sentimento dos fãs em relação à Fórmula 1, com foco num público que está em crescimento, o feminino. Com base em 5 000 comentários públicos recolhidos no Instagram e no X, a investigação utiliza o csqca para identificar as combinações de condições que levam a reações positivas ou negativas. A análise mostra que o tom emocional é a única condição simultaneamente necessária e suficiente para gerar sentimento positivo, confirmando o papel central do envolvimento afetivo nas comunidades digitais da F1. As outras variáveis, representação, menções a marcas, expectativas de conteúdo e género, surgem apenas em trajetórias negativas e apenas quando o tom emocional está ausente. Estes resultados reforçam a importância da narrativa emocional, da comunicação inclusiva e de estratégias de conteúdo adequadas para envolver públicos diversos. O estudo contribui para a investigação em marketing desportivo ao demonstrar o valor dos métodos configuracionais na análise do comportamento digital dos fãs e ao clarificar como os mecanismos emocionais moldam o envolvimento na F1 contemporânea.

Palavras-chave: Fórmula 1, marketing desportivo, tom emocional, sentimento dos fãs, análise configuracional, envolvimento nas redes sociais

Classificação JEL: M31 (Marketing), L83 (Estudos da Indústria: Serviços - Desporto)

Abstract

This study examines how emotional and informational cues shape fan sentiment toward Formula 1, with a focus on the growing female audience. Using 5 000 public comments collected from Instagram and X, the research applies crisp-set qualitative comparative analysis to identify the combinations of conditions that lead to positive or negative reactions. The analysis shows that emotional tone is the only condition that is both necessary and sufficient for positive sentiment. It confirms the central role of affective engagement in F1's digital communities. Other variables such as, representation, brand mentions, content expectations, and gender, appear only in negative pathways and only when emotional tone is absent. These results highlight the importance of emotional storytelling, inclusive communication, and balanced content strategies for engaging diverse audiences. The study contributes to sports marketing research by demonstrating the value of configurational methods for analysing digital fan behavior and by clarifying how emotional mechanisms shape engagement in modern F1.

Keywords: Formula 1, sports marketing, emotional tone, fan sentiment, configurational analysis, social media engagement

JEL classification: M31 (Marketing), L83 (Industry studies: Services - Sports)

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1. Introduction

Formula 1 (F1) is recognized as the pinnacle of motorsport and has become a major global entertainment brand. Since Liberty Media acquired the sport in 2017, F1 has shifted away from its traditional male-dominated identity to attract a younger and more diverse audience, especially women (Shah & Williams, 2024; Soble & Lowes, 2024). This strategic repositioning relied heavily on digital expansion, social media visibility, as well as new forms of storytelling. The Netflix series *Drive to Survive* (DTS) has played a key role in this change by using emotional storytelling to turn casual viewers into committed fans (Soble & Lowes, 2024). As a result, global viewership reached 1.54 billion in 2022 (Shah & Williams, 2024). This showed how emotional storytelling can reshape the image of a sport and attract new audiences. With this growing diversity, understanding the emotional behavior of female fans has become essential for F1 teams and partners who want to adapt their communication strategies (Lick et al., 2024).

Academic research on F1 fandom often relies on engagement theory, which describes fan involvement as a mix of cognitive, emotional, and behavioral responses (Hollebeek & Chen, 2014). Because F1 is a hedonic and experiential sport, fans seek excitement, thrill, and joy (Jones et al., 2019). This emotional dimension is reinforced by the fast pace of the sport, the unpredictability of the race outcomes, as well as the strong personalities of the drivers and the teams. Studies on DTS show that the series helps fans learn about the sport through human-centred stories and emotional narratives (Shah & Williams, 2024). At the same time, sentiment analysis and natural language processing tools help marketers understand the emotions expressed by online fans (Lye & Wijesinghe, 2024). Research also suggests that male fans often focus on technical aspects, while female fans value social experiences and emotional storytelling (Chiu & Leng, 2021; Toffoletti, 2017).

Despite the rapid growth of female fans, only little research has examined their specific emotional behavior. There is still a conceptual gap in understanding the psychological mechanisms behind fan engagement in modern F1 (Lick et al., 2024). Although Liberty Media has targeted this demographic since 2018, few studies explore how female fans influence F1's content, sponsorships, and brand strategies (Jensen et al., 2024). Existing research often focuses on single variables or isolated effects, which makes it difficult to understand how emotional, social, and informational factors interact. Traditional net-effects methods also struggle to capture how emotional factors interact. More advanced approaches such as configurational comparative methods, have not yet been used to study how combinations of

variables like emotional tone and representation, shape female fan sentiment (Alonso-Dos-Santos et al., 2018).

This thesis draws on various theories, such as the social learning theory (Bandura, 1977) and the engagement theory (Hollebeek & Chen, 2014) to examine how fans learn through media exposure and how they form emotional connections with the sport. Social learning theory helps explain how repeated exposure to emotional narratives shapes attitudes and behaviors. Engagement theory provides a framework to understand how emotional, cognitive, and behavioral responses interact in digital communities. Using these theoretical foundations, the main objective is to analyse how F1's marketing adapts to female emotional behavior through a configurational approach. Crisp-set qualitative comparative analysis (csqca) (Ragin, 2008) is used to identify the combinations of conditions that lead to positive or negative sentiment. The research addresses three key questions:

1. RQ1: How do emotional tone, representation, and brand mentions influence female sentiment toward F1?
2. RQ2: Does gender moderate the relationship between emotional tone and positive sentiment toward F1?
3. RQ3: To what extent does emotional tone influence female fans' positive feelings toward F1?

This study offers both theoretical and practical contributions. Theoretically, it shows that in hedonic sports consumption, the emotional dimension is the main driver of engagement. Cognitive and behavioral cues matter only when emotion is absent (Jones et al., 2019; Dessart et al., 2015). It also challenges the selectivity hypothesis by showing that strong emotional narratives can create similar reactions across genders (Meyers-Levy, 1988). Methodologically, it introduces configurational analysis to the F1 context which offers a new way to study how multiple emotional and informational factors interact. Practically, the findings provide guidance for marketers regarding segmentation, inclusive storytelling, as well as the importance of active community moderation to support and engage the growing female fan base (Lick et al., 2024; Fenton et al., 2023). The results also help organizations understand how emotional tone can be used to strengthen fan loyalty and improve digital communication strategies in a rapidly evolving sports environment.

This dissertation is organized into six chapters. The introduction presents the context of the research, the importance of the topic, and the main research questions. Chapter two reviews the literature. It explains how F1 has changed in recent years and how emotional, social, and

digital factors shape fan behavior. It also highlights the rise of female fans and the gaps in current research. Chapter three describes the methodology. It presents the data, the coding process, and the use of crisp-set qualitative comparative analysis. Chapter four shows the results of the configurational analysis and the main patterns found in fan sentiment. The fifth chapter discusses these findings and connects them to existing academic work. Lastly, the final chapter reflects on the broader implications of the results and how they relate to F1's marketing strategies. The dissertation ends with a conclusion that summarizes the key insights, acknowledges the limitations, and proposes directions for future research.

2. Literature review

F1 is known as the pinnacle of motorsport and a major global entertainment product (Jensen et al., 2024). Millions of people watch F1 each year, making it one of the world's most consumed spectator sports. Its global profile has expanded through strategic growth efforts and institutional changes that influence international brand partnerships (Jensen et al., 2024). A major turning point came in 2017, when Liberty Media purchased the Formula One Group (Jensen et al., 2024). Unlike previous leadership, which focused on older and wealthier fans (Shah & Williams, 2024), Liberty Media targeted a younger and more diverse audience, especially women (Shah & Williams, 2024; Soble & Lowes, 2024). This shift relied heavily on strengthening F1's digital presence and producing unique online content (Soble & Lowes, 2024; Shah & Williams, 2024). A key element of this transformation was the Netflix series DTS, which helped reposition F1 as a global entertainment brand (Shah & Williams, 2024). DTS uses narrative storytelling, focusing on personalities and rivalries rather than technical details (Shah & Williams, 2024; Soble & Lowes, 2024). This approach has proven effective for attracting new fans, who often begin watching for entertainment and later deepen their engagement through the educational elements of the series (Shah & Williams, 2024). By 2022, F1 reached 1.54 billion TV viewers worldwide (Shah & Williams, 2024).

A central part of this growth has been the rise of female viewership (Shah & Williams, 2024). Historically, F1 was seen as a masculine sport shaped by a patriarchal culture (Dewhirst et al., 2023). Although recent changes such as ending the use of grid girls, show a shift toward inclusivity (Dewhirst et al., 2023), female fans still face challenges. Research shows they often experience sexism, feel pressure to prove their legitimacy, and encounter hostile online environments (Lick et al., 2024). Many avoid commenting on social media due to fear of negative reactions (Lick et al., 2024), which can lead to disengagement (Doehler, 2024). Female fans also tend to value social and entertainment-based experiences, such as concerts or watching with friends, more than male fans do (Chiu & Leng, 2021). At the same time, they represent a growing segment with strong buying power (Fenton et al., 2023), which increases interest in gender-focused marketing strategies (Park et al., 2023; Robertson & Davidson, 2013).

Sport managers need to recognize these gender-based differences and the issues affecting female publics (Lick et al., 2024), especially since female fans represent a growing segment with significant buying power (Fenton et al., 2023). This highlights a growing interest regarding the perceived authenticity of advertising aimed at women, such as femvertising. This

is when the brand-message alignment and consumer involvement play a role in attitude formation (Park et al., 2023; Robertson & Davidson, 2013).

This literature review summarizes current academic discussions on F1's global growth and its increasingly diverse audience (Soble & Lowes, 2024). It focuses on the emotional involvement of fans and examines the main factors shaping sentiment toward F1: emotional tone, representation, influencer or brand mentions, and content expectations. By reviewing existing research on these variables, this section prepares the foundation for the configurational analysis used to understand how these combined factors influence female fan sentiment in F1's digital communities.

2.1. The emergence of the female audience in motorsport

It seems like the female audience in sports is growing everywhere (Toffoletti, 2017). Historically, sports fandom, especially in motorsports and football, was seen as a male thing (Fenton et al., 2023). It had typical fan activities modeled on the actions of white, male, heterosexual subjects (Toffoletti, 2017). Because of this long-standing masculine culture, women often felt marginalized and had to prove their legitimacy as fans (Fenton et al., 2023; Pitti, 2019; Doehler, 2024). Research shows that a feminization of sports fandom began in the 1990s, as leagues and media recognized women's growing involvement and economic potential (Pope, 2017; Fenton et al., 2023). By 2008, women already represented 34-40% of fans in major North American leagues (Sveinson & Hoeber, 2015), and today they make up around 26-30% of UK football spectators (Fair Game UK, 2022; Doehler, 2024).

F1 has followed this trend. Under previous leadership, the sport did not prioritize younger or female audiences (Shah & Williams, 2024). This changed when Liberty Media took over in 2017 and focused on attracting these groups through stronger digital and social media strategies (Shah & Williams, 2024). The Netflix series DTS is widely credited for the rise in female F1 viewership (Soble & Lowes, 2024). The show uses narrative storytelling, focusing on personalities, rivalries, and emotional moments rather than technical details, to convert newcomers into engaged fans (Soble & Lowes, 2024; Shah & Williams, 2024). These narratives help build emotional connections and support learning about the sport (Shah & Williams, 2024).

Research also highlights differences in motivations between male and female fans. Women tend to process information more comprehensively (Kol & Levy, 2023) and often value social and entertainment-based experiences, such as watching with friends or enjoying

event activities (Pope, 2017). Men, in contrast, are more motivated by the sport itself and technical information (Toffoletti, 2017). However, when measuring actual interest in the sport, these differences sometimes disappear (Pope, 2017; Sveinson & Hoeber, 2015).

Female motorsport fans face additional challenges online. Sexism remains common in fan communities (Doehler, 2024), and many women avoid commenting on social media due to fear of negative reactions (Lick et al., 2024). This leads some to disengage or hide their identity through profile changes (Doehler, 2024). As a result, women often move to private micro-communities for safer discussions, even if this reduces their visibility to teams (Fenton et al., 2023). To encourage participation, research suggests that F1 teams should post emotional and entertaining content, such as humorous posts, driver-focused content, and race highlights, and actively moderate comments to create a safer environment (Lick et al., 2024). In the literature, emotional tone appears to have a stronger influence on positive sentiment among female fans, who respond particularly well to emotional and entertainment-driven content.

2.2. User-generated content and fan engagement

User-generated content (UGC) refers to material created and shared by users on digital platforms, such as comments, shares, reviews, and ratings (Antony et al., 2025). With social media, fans have become active consumer-actors who freely produce and circulate content (Asmae, 2023; Dessart et al., 2015). UGC is seen as trustworthy and authentic. It is often more credible than brand-produced messages (Antony et al., 2025). It encourages personal opinions, social interaction, and knowledge sharing, making it a key driver of brand engagement across platforms.

In sports, UGC plays an important role in shaping a brand's identity. When fans share their experiences, they contribute to electronic word-of-mouth, which strengthens community ties and increases visibility (Jones et al., 2019). Sports organizations rely on UGC to attract new fans and maintain strong relationships with existing ones (Geurin & Burch, 2017). Engagement is often measured through likes, comments, and shares (Tanaltay et al., 2025). Sharing signals a higher level of commitment than liking or commenting (Annamalai et al., 2021), and comments have a strong impact on brand trust and brand engagement because they allow direct interaction between fans and the brand (Antony et al., 2025).

To understand this large volume of UGC, marketers often use sentiment analysis, which identifies the emotional tone of fan reactions (Lye & Wijesinghe, 2024). Machine-learning tools also help classify emotions and detect how fans respond to specific posts (Lick et al.,

2024). Netnography is another method used to study online fan interactions and uncover deeper patterns in behavior and motivation (Chiu & Leng, 2021).

UGC analysis is especially relevant in F1, where much of the fan base is active online. Fan reactions can influence team and driver morale in this fast-paced environment (Lye & Wijesinghe, 2024). Research shows that male fans often focus on race-related themes, while female fans highlight entertainment and social experiences (Chiu & Leng, 2021). The literature confirms that UGC is a key and authentic source of fan engagement and is essential for understanding sentiment and behavior in modern sports communities.

2.3. The impact of emotional tone on brand perception

Emotions play a central role in how consumers interact with brands (Tanaltay et al., 2025). This is especially true in sports, where fan involvement and loyalty are highly emotional (Antony et al., 2025). Emotional tone shapes the overall experience with a brand, and emotional appeals in content can influence reactions, comments, and shares (Tanaltay et al., 2025). Positive emotions also increase perceived value and advertising effectiveness, giving brands a competitive advantage (Dwivedi et al., 2021).

Emotions are a key part of consumer engagement, which includes both emotional and cognitive commitment (Hollebeek & Chen, 2014). Affective engagement refers to strong feelings such as enthusiasm and enjoyment within a brand community (Dessart et al., 2015). This aligns with the nature of sports, which are hedonic experiences built on thrill, joy, and excitement (Jones et al., 2019). Emotional storytelling is therefore an effective way for sports organizations to increase engagement (Tanaltay et al., 2025). Research also shows that advertising aligned with gender-role expectations can shape more favourable attitudes (Robertson & Davidson, 2013).

Affective engagement is one of the main ways consumers interact in online brand communities (Dessart et al., 2015). Emotions expressed in UGC are linked to satisfaction, loyalty, and brand trust (Tanaltay et al., 2025; Antony et al., 2025). Strong emotional commitment often leads to advocacy and long-term loyalty. A positive cognitive image must also trigger emotion, since affective responses are the primary driver of consumer behavior and recommendations (Stojanovic et al., 2018).

Emotional tone is particularly important in F1, where fan reactions can influence team and driver morale (Lye & Wijesinghe, 2024). The success of DTS shows how narrative and emotional storytelling help new fans connect with the sport (Soble & Lowes, 2024). Research

suggests that F1 teams should create emotional and entertaining content to increase participation, especially among female fans (Lick et al., 2024).

While many studies classify emotions simply as positive or negative (Tanaltay et al., 2025), a deeper analysis of specific emotions, such as excitement, anger, or sadness, provides more meaningful insights into fan engagement (Lye & Wijesinghe, 2024). Measuring specific positive emotions like thrill and joy helps quantify the hedonic value of the F1 experience (Jones et al., 2019). Understanding these emotional responses is essential for identifying which elements of the sport generate affective reactions.

2.4. Representation and inclusion in fan communities

Representation, diversity, and inclusion have become central issues in media and marketing (Toffoletti, 2017). Digital technologies now give sports organizations new opportunities to diversify both athletes and fan communities (Standaert & Mazurova, 2024). By promoting diversity, these organizations signal a commitment to gender equity and more inclusive fan spaces (Toffoletti, 2017).

Marketing strategies such as femvertising aim to challenge harmful gender stereotypes by portraying women as confident and empowered (Negm, 2023). Visible representation helps recognize women as legitimate fans and taps into a demographic with strong purchasing power (Pope, 2017; Toffoletti, 2017). For sports clubs, supporting female voices and encouraging tolerance in online spaces is essential (Fenton et al., 2023). In motorsport, community managers are encouraged to moderate comments actively and promote inclusive behavior to create safer environments (Lick et al., 2024). Representation should also challenge traditional, male-defined expectations of how fans should behave (Toffoletti, 2017).

Despite these efforts, exclusion remains common in many fan communities. In male-dominated sports spaces, old gender dynamics often persist (Doehler, 2024). Women frequently face stereotypes, harassment, and pressure to prove their legitimacy as fans (Doehler, 2024). This hostile environment leads many female fans to avoid commenting, self-censor, or hide their identity through profile changes (Lick et al., 2024; Fenton et al., 2023). Some withdraw entirely, while others move to private micro-communities for safer interactions (Lick et al., 2024; Fenton et al., 2023).

Fandom plays an important role in identity and belonging (Toffoletti, 2017). Feeling welcomed in a community increases participation, commitment, and brand use (Fenton et al., 2023). However, academic research has often overlooked the experiences of female sports fans

(Pope, 2017), and there is still limited work on female engagement in motorsport social media communities (Lick et al., 2024). This gap is significant, especially as F1 increasingly relies on digital media to attract younger and more diverse audiences.

Understanding how female F1 fans discuss representation can provide valuable insights. Positive mentions of inclusion are likely to align with positive sentiment toward the sport, while mentions of exclusion or hostility are more likely to correlate with negative reactions. Studying this variable helps clarify how representation shapes emotional responses and overall engagement within F1's online fan base.

2.5. The role of influencers and brands in the F1 ecosystem

Social media influencers play an important role in modern marketing because they reach large audiences and act as opinion leaders online (Gräve, 2019). Their value comes from their perceived authenticity and ability to communicate genuinely, even when content is sponsored (Gräve, 2019). Influencer marketing often involves paid collaborations, and endorsements from trusted influencers can strengthen consumer trust and engagement (Kol & Levy, 2023).

Influencers vary in size, from nano- to mega-influencers (Brison & Geurin, 2021). Nano- and micro-influencers are often seen as more accessible and authentic, making them effective endorsers despite having smaller followings (Brison & Geurin, 2021). Athletes also act as influencers due to their celebrity status and ability to interact directly with fans on social media (Standaert & Mazurova, 2024).

In F1, digital tools have increased the visibility and influence of drivers, allowing teams and sponsors to build strong character-based narratives (Jensen et al., 2024). Engagement, not follower count, is now a key indicator of an influencer's value (Brison & Geurin, 2021). As engagement rates decline for mega-influencers, brands increasingly turn to smaller creators with stronger audience connections (Brison & Geurin, 2021).

Engagement metrics such as likes, shares, and comments are commonly used to evaluate campaign success (Brison & Geurin, 2021). Comments are strong indicators of brand trust and brand engagement because they allow users to express opinions and interact with the brand (Antony et al., 2025). These interactions contribute to electronic word-of-mouth (eWOM), which can influence purchase intentions and loyalty (Brison & Geurin, 2021; Tanaltay et al., 2025).

F1 relies heavily on brand partnerships, with teams generating over 70% of their operating budgets from sponsors (Jensen et al., 2024). Sponsorships offer global visibility due to the sport's international reach and real-time viewing culture (Jensen et al., 2024). The perceived fit between the influencer, the sponsor, and the brand is essential for positive outcomes (Brison & Geurin, 2021). Some F1 partners now highlight themes like innovation and teamwork to align with modern brand values and move away from traditional masculine imagery (Dewhirst et al., 2023).

Fan mentions of brands and influencers provide valuable insight into expectations and perceived authenticity (Stavros et al., 2013). Active fan engagement such as liking, commenting, sharing, helps co-create value and strengthens loyalty (Abeza & Sanderson, 2022). Interactivity features such as mentions and hashtags also increase post popularity and community building (Tanaltay et al., 2025). Moreover, sentiment analysis helps brands understand how fans feel about campaigns and partnerships (Lye & Wijesinghe, 2024). Net sentiment (positive minus negative comments) is considered a more reliable measure of campaign success than simple reach or likes (Gräve, 2019).

The modern F1 ecosystem depends strongly on influencers and brand partnerships. The variable mention of influencer or brand captures how fans express expectations about authenticity and trust. Positive mentions often reflect satisfaction with the influencer–brand fit and are likely to correlate with positive sentiment toward the sport (Tanaltay et al., 2025).

2.6. Content expectations and fan experience

Consumer satisfaction and behavior are strongly influenced by perceived quality and value (Jones et al., 2019). Perceived value reflects the consumer's assessment of what they receive compared to what they give (Ajina, 2019). In sports, expectations about services and the event environment shape this value and influence future behavior (Jones et al., 2019). When brands meet these expectations, they strengthen brand trust and engagement (Antony et al., 2025; Dwivedi et al., 2021).

Social media plays a key role in shaping fan experience. Effective content should support motives such as hope, passion, esteem, and camaraderie (Stavros et al., 2013). Social media marketing increases visibility, encourages interaction, and provides valuable feedback (Asmae, 2023). The uses and gratifications theory explains that users choose media to satisfy needs such as information, entertainment, or social connection (Abeza & Sanderson, 2022).

Different audiences prefer different types of content (Annamalai et al., 2021). Research shows that men and women often perceive value differently when searching for information (Kol & Levy, 2023). Women tend to process information more comprehensively, use multiple sources, and seek visually appealing, hedonic, and inspirational content (Kol & Levy, 2023). They also rely on non-commercial UGC for emotional support and reduced risk in decision-making. Men, on the other hand, prefer functional, reliable information and community-focused content (Kol & Levy, 2023).

Cultural differences also shape content expectations. Individualistic cultures respond more to informative and entertaining content, while collectivist cultures prefer emotional and community-oriented messages (Tanaltay et al., 2025). In sports, social content drives the highest engagement because it satisfies the need for belonging and interaction (Annamalai et al., 2021). This engagement supports value co-creation, where fans actively participate and gain benefits from their experiences (Dwivedi et al., 2021).

In the general sports context, social content drives maximum fan engagement. It satisfies the need for community affiliation and social interaction (Annamalai et al., 2021). This engagement is crucial for value co-creation, which involves consumers actively participating with the brand (Dessart et al., 2015). Value co-creation happens when customers receive benefits from their experiences (Dwivedi et al., 2021). Successful relationship marketing relies on interaction and dialogue to facilitate this co-creation of value (Abeza et Sanderson, 2022; Annamalai et al., 2021).

Understanding content expectations is essential for improving the F1 fan experience (Lick et al., 2024. The sports industry relies on high emotional involvement and loyalty, which are shaped by inconsistent outcomes and multiple stakeholders (Antony et al., 2025). F1 teams use social media to maintain relationships through informative and entertaining content (Lick et al., 2024). Managers must combine UGC and firm-generated content to build strong fan relationships and drive engagement (Antony et al., 2025). Event organizers should also enhance utilitarian value such as price and quality, to improve the overall experience (Jones et al., 2019).

The variable content expectation captures what fans want from F1 content and how these expectations shape their emotional responses. For the growing female audience, the literature shows a clear preference for emotional, entertaining, and social content. When these expectations are met, fans are more likely to express positive feelings toward the sport. Because social content drives the highest engagement, analysing content expectations is essential for understanding and improving F1 fan sentiment.

2.7. Synthesis and gaps in the literature

The literature shows that female fans often feel excluded in sports spaces traditionally dominated by men (Pope, 2017). Sexism remains common in fan communities, leading many women to feel they must constantly prove their legitimacy as fans (Doehler, 2024; Fenton et al., 2023). As a result, female supporters often turn to smaller micro-communities online for safer discussions, which reduces their visibility to teams and brands (Fenton et al., 2023; Lick et al., 2024). Many also self-censor to avoid negative reactions (Doehler, 2024).

Research consistently shows that emotional, creative, and entertaining content generates the strongest engagement among female motorsport fans (Lick et al., 2024). This aligns with findings that women search for information that matches their motivations and values, often preferring visually appealing and hedonic content (Kol & Levy, 2023). In motorsport, this includes emotional driver-focused posts, race highlights, and promotional content that is enjoyable and easy to engage with (Lick et al., 2024).

UGC is especially important for sports brands because it is perceived as more authentic and trustworthy than firm-generated content (Antony et al., 2025). Comments and fan discussions have a stronger impact on brand trust and engagement than traditional marketing messages (Antony et al., 2025). Emotional tone also shapes content popularity, although its influence varies across cultural contexts (Tanaltay et al., 2025). Measuring specific emotions such as happiness, excitement, or thrill, helps capture the hedonic value fans derive from the sport (Jones et al., 2019). Tools like sentiment analysis allow brands to automatically interpret these emotional reactions (Lye & Wijesinghe, 2024; Gräve, 2019).

Authenticity is also essential in brand and influencer strategies, especially when targeting female consumers (Negm, 2023). Sponsors perceived as sincere or motivated by social good receive more positive responses than those seen as purely commercial. Narrative storytelling, as seen in DTS, is another powerful tool for building emotional connections and converting new audiences into fans (Shah & Williams, 2024; Soble & Lowes, 2024). These narratives help fans identify with drivers and teams on a human level, supporting long-term engagement and growth (Shah & Williams, 2024).

Despite these insights, major gaps remain in the academic literature (Antony et al., 2025). Many studies focus on limited platforms or cultural contexts, making it difficult to generalize findings (Dwivedi et al., 2021). There is currently no research examining how the rise of female F1 fans is reshaping the sport's content strategies, sponsorship models, or brand positioning, despite Liberty Media's clear focus on younger and female audiences since 2018.

There is also a lack of research on the psychological mechanisms behind fan engagement, leaving conceptual gaps in understanding emotional behavior (Dessart et al., 2015). Existing studies have not explored how the specific emotional patterns of female fans influence engagement in the F1 context (Lick et al., 2024). Complex methods such as configurational comparative methods have not been used to examine how multiple emotional drivers interact to shape female fan sentiment (Alonso-Dos-Santos et al., 2018). More work is needed to understand how audience characteristics influence engagement outcomes (Dwivedi et al., 2021).

This research aims to address these gaps by analysing female emotional behavior toward F1 (Jensen et al., 2024). Given that F1 teams rely heavily on corporate partnerships, understanding how fans respond to content, brands, and influencers is essential. By applying configurational comparative methods, this study identifies the necessary and sufficient conditions that shape female emotional responses. This approach helps clarify how different emotional drivers work together and responds to calls for more nuanced research on emotional engagement (Dessart et al., 2015).

3. Methodology

This study follows a qualitative-to-quantitative research design based on UGC. The data come from public comments posted on Instagram and X (Twitter), two platforms that play a central role in F1's digital ecosystem. They are also widely used by teams, drivers, sponsors, and fans, who have been active on them for years. Also, the volume of comments is high, and the discussions are richer and more emotional compared to newer video-focused platforms like TikTok. The unit of analysis in this research is an individual comment, and each comment represents one case in the dataset.

To ensure that the data reflected direct interaction with the sport, only comments from the official accounts of F1, Mercedes, McLaren, Ferrari, and Red Bull Racing were included. Five types of posts were selected to represent the main pillars of F1's digital communication strategy: race-related updates, driver-focused storytelling, lifestyle and behind-the-scenes content, sponsorship or brand collaborations, and entertainment-oriented posts. This mix allowed to capture both the technical discussions and the emotional, human-centred narratives highlighted in the literature.

The data cover an 18-week period between November 2nd 2025, and March 5th 2026, which includes the end of the 2025 season and the buildup to the 2026 season. This period was chosen because it is one of the most active moments of the year, with car launches, livery reveals, and pre-season testing, generating strong emotional reactions. The physical task of collecting and coding the data took place between the months of January and March 2026. Before cleaning, approximately 7 000 comments were screened. Inclusion criteria required comments to be written in English or French, to contain identifiable variables from the conceptual model, and to be relevant to the research questions. The final dataset consisted of 5 000 comments (see annex D). Reaching this number was important because after a certain point, the emotional and thematic patterns became repetitive and stable. This is ideal for a configurational analysis.

To prepare the data for analysis, all comments were anonymized by replacing usernames with unique IDs (C001, C002). It ensured privacy while maintaining traceability during the coding process. Data cleaning involved removing bots, spam, and comments with no meaningful content, such as random strings of characters. Comments that did not express any identifiable variable were also excluded. When comments contained mixed emotions, a dominant-tone logic was applied. For example, the comment "*Car is fast but looks ugly*" was

coded as negative because frustration with aesthetics was the main message. Neutral or ambiguous comments such as "*Noted*" were coded as 0 to indicate the absence of emotional expression. French comments were coded in their original language to preserve nuance. For instance, "*Trop forte, bravo Doriane*" was coded as a positive emotional tone.

Once cleaned, the qualitative content was transformed into binary variables aligned with the conceptual model (see annex C). The dependent variable, feeling toward F1, was coded as 1 for positive sentiment and 0 for negative sentiment. The independent variables were also coded in binary form. Emotional tone was coded as 1 when comments expressed positive affect such as joy, excitement, or pride. It was coded as 0 when they expressed negative affect or lacked emotional language. Representation was coded as 1 when comments explicitly mentioned gender, inclusion, or diversity, and 0 otherwise. Mentions of brands or influencers were coded as 1 when a driver, sponsor, or partner was named, and 0 when comments remained general. Content expectations were coded as 1 when fans expressed a desire or suggestion for future content, and 0 when comments were simply reactive. Gender was recorded only when identifiable from the user's public profile (username, pronouns, or bio). Otherwise, it was coded as 0 (unknown). This ensured that gender appeared only when it was verifiable to avoid assumptions based on ambiguous profiles.

Because all the variables were naturally binary, making crisp-set qualitative comparative analysis was the most appropriate method. The threshold between 0 and 1 was defined by the presence or the absence of specific markers. For emotional tone, this meant identifying clear emotional words such as "*excited*," "*proud*," or "*love*". For representation, brand mentions, and content expectations, the threshold relied on explicit mention versus silence. It ensured consistency across the dataset. After coding the 5 000 comments, the dataset was imported into csqca software, which grouped all cases into a truth table that displayed every possible combination of the five variables. This step made it possible to move from individual comments to shared behavioral patterns.

The analysis produced three significant configurations: one leading to a positive feeling (C1) and two leading to a negative feeling (C2 and C3). Emotional tone emerged as the only necessary and sufficient condition for positive sentiment. The absence of emotional tone combined with other missing variables explained negative reactions. Lastly, to ensure reliability, the coding was conducted in structured batches to avoid fatigue. Standardized definitions of emotional markers were also used throughout the process. The coding guide was refined during the initial phase to include specific F1 slang and terminology that appeared in the data such as expressions that are specific to the F1 community. Ethically, only publicly

accessible comments were used, and the terms of use of Instagram and X were respected. Sensitive or inappropriate content was removed during the cleaning phase, and all data were stored securely.

The structured approach made it possible to analyse emotional expression and expectations within F1 fan communities in a clear and consistent way. Csqca was particularly appropriate because it focuses on how combinations of conditions lead to an outcome rather than isolating variables individually. In csqca, a necessary condition is one that must always be present for the outcome to occur, while a sufficient condition is one that can produce the outcome on its own (Ragin, 2008). In this study, the method helped clarify how emotional tone, representation, brand mentions, content expectations, and gender interact to shape fan sentiment. It offered a nuanced understanding of the emotional dynamics within the F1's digital communities.

4. Results

The analysis was conducted using csqca following Ragin's (2008) guidelines. Two key metrics guided the interpretation of the results. Consistency, which indicates how reliably a condition leads to an outcome. Coverage, which shows how much of the outcome the condition explains. These two measures help determine whether a condition is necessary, sufficient, or irrelevant in shaping fan sentiment.

To understand these results, it is important to explain how the data was entered in the csqca process. The raw comments (annex D) were first analysed qualitatively. Then, they were converted into binary values using the coding rules described in Annex C. This step ensured that the truth table was based on real linguistic patterns. For example, comments like "*Dreaming of the day we will see her as an F1 driver* 💔" were coded as emotional = 1 and feeling = 1 because they expressed clear positive affect. However, comments such as "*It's really funny that everyone thinks they will ever reach F1. They won't* 🤣" were coded as emotional = 0 and feeling = 0, since they reflected sarcasm and discouragement. These coded comments were then added to the truth table. They directly shaped the configurations shown in Annexes A and B. This clear link between the raw data, the coding, and the csqca results makes the analysis more transparent and reliable.

The first step of the analysis was to examine the necessary conditions tables for both positive and negative outcomes. According to Ragin, a condition is considered necessary when its consistency score exceeds 0.90. It means that the outcome almost never occurs without it. In this study, emotional tone is the only variable that meets this threshold. For the positive outcome, emotional tone has a consistency score of 0.995, indicating that almost every positive comment contained some form of emotional expression such as excitement, joy, pride, or admiration. This means that positive emotional tone is a necessary condition for positive sentiment toward F1. Without emotional expression, positive reactions rarely occur. This finding is reinforced by the qualitative coding process, where many positive comments were short affective reactions such as "*I love this*," "*so proud*," "*this made my day*," or "*amazing moment*." These comments did not rely on representation, brand mentions, or content expectations. Instead, they expressed pure emotional responses, confirming the central role of affective engagement in F1's digital communities.

For the negative outcome, the absence of emotional tone also exceeds the 0.90 threshold, with a consistency score of 0.967. This means that low or negative emotional tone

is a necessary condition for negative sentiment. When fans express disappointment, frustration, or criticism, emotional tone is almost always absent or negative. All other variables such as representation, brand mentions, content expectations, and gender, have consistency scores far below 0.90 for both outcomes. This means that none of these conditions are necessary on their own. They may still play a role in specific combinations, but they cannot independently explain positive or negative sentiment. This first step already reveals a strong pattern. It shows that emotion is the foundation of fan sentiment, while all other variables operate only in the absence of emotional expression. (See annex A).

The second step of the analysis was to build the truth table and identify the combinations of conditions that lead to high or low feelings toward F1. The csqca produced three configurations: one leading to high feeling (C1) and two leading to low feeling (C2 and C3). These configurations show how different conditions interact to produce the outcome.

The first configuration, C1, is the simplest and strongest pathway in the entire model. It requires only one condition: the presence of emotional tone. No other variable appears in the solution. This configuration has extremely high consistency (0.998) and coverage (0.995), showing that positive emotional tone alone is sufficient to generate a positive feeling toward F1. This applies to both men and women, indicating that emotional tone operates similarly across genders. This finding challenges earlier assumptions that gender would significantly shape emotional reactions in sports contexts. C1 also reflects the qualitative patterns observed during coding. Many positive comments were short emotional reactions without any reference to representation, brands, or content expectations. This confirms that emotion is the main driver of positive engagement, and that informational or representational cues are secondary.

The second configuration, C2, identifies a pathway to negative sentiment when both emotional tone and representation are absent. This configuration has high consistency (0.931) and the highest coverage among the negative pathways (0.925). This means that when comments lack emotional expression and do not mention representation, fans are significantly more likely to express negative feelings. This result aligns with the literature showing that a lack of representation can contribute to disengagement. Especially among women who often feel marginalized in male-dominated sports spaces. However, the fact that representation appears only in a negative pathway and not in the positive one, is interesting. Representation can reduce negativity, but it cannot generate positivity on its own. It becomes relevant only when emotional tone is already low. This finding challenges the assumption that representation

is always a strong driver of engagement. It also shows that its influence depends on the emotional context.

The third configuration, C3, identifies a more specific pathway to negative sentiment. This configuration appears when emotional tone, brand mentions, and content expectations are all absent, and the person is a male fan. In this situation, male fans are more likely than female fans to express negative feelings. This suggests that men are more likely to express negative sentiment when both emotional and informational cues are missing. This aligns with research showing that male fans often engage with sports through technical, informational, or brand-related content. When these elements are missing, and there is no emotional tone to compensate, male fans express more negativity. This is the only configuration where gender plays a role. This means that gender differences emerge only in very specific low-emotion and low-information situations. (See annex B).

Putting all the results together, the csqca analysis shows a clear and consistent pattern. Positive feeling is almost entirely driven by emotional expression. However, negative feeling emerges when emotional expression is absent. Representation, brand mentions, and content expectations matter only in negative pathways and only when emotional tone is missing. Gender differences are minimal and appear only in one configuration. Emotion is therefore the central mechanism that shapes how fans react to F1 content. When fans feel excited, happy, or proud, they express it, and this emotional tone becomes the main driver of positive sentiment. When emotional tone is absent, fans rely more on representation or informational cues, which can lead to negative reactions.

These results directly address the research questions. Emotional tone is the only condition that consistently predicts positive sentiment, while the other variables appear only in specific pathways leading to negative outcomes. Gender appears only within one specific configuration associated with negative outcomes. Emotional tone has a direct and dominant influence on positive feelings toward F1. In conclusion, the results confirm that emotion is the main driver of fan engagement in F1's digital communities and that emotional expression shapes both positive and negative reactions more strongly than any other variable in the model.

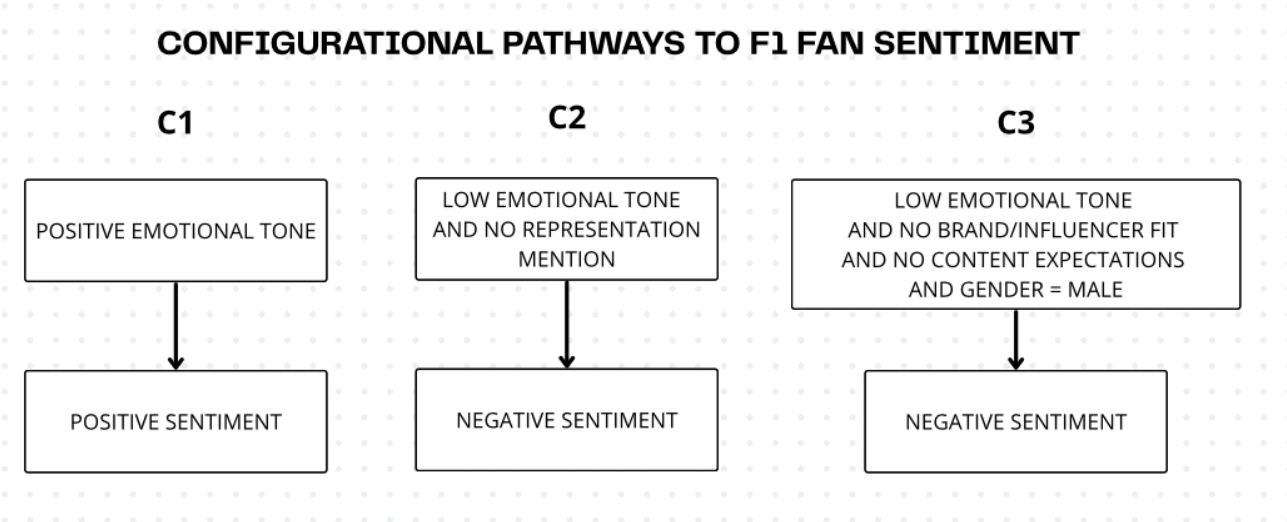


Figure 1: Configurational pathways to F1 fan sentiment

5. Discussion

The main finding of this study is that emotional tone is the strongest and most reliable factor influencing fan sentiment toward F1. The configurational analysis shows that a positive emotional tone is the only condition that is both necessary and sufficient for fans to express a positive feeling toward the sport. This means that when comments contain positive emotions, fans react positively regardless of representation, brand mentions, content expectations, or gender. This result is interesting because the literature suggested that representation, brand engagement, and content expectations would also play major roles in shaping reactions. However, their consistency scores were far below the threshold that is required to be considered necessary. The cscqa results clearly show that emotions dominate the model and that men and women respond in the same way when emotional tone is high. This challenges the idea that gender always divides sports audiences. It also suggests that emotional expression functions as a shared driver of engagement across the entire fan base.

Configuration C1 is the simplest and strongest pathway in the entire model. It shows that a positive emotional tone alone is enough to generate a positive feeling toward F1. No other condition needs to be present. This result strongly supports previous research that highlights the central role of emotions in sports and digital engagement. For example, Tanaltay et al. (2025) and Dwivedi et al. (2021) show that emotional appeals increase brand popularity and strengthen brand equity. Dessart et al. (2015) also describe enthusiasm and enjoyment as key components of affective engagement in online communities. In the context of F1, Jones et al. (2019) explain that the sport is built around thrill, excitement, and hedonic value. Similarly, Soble and Lowes (2024) argue that the success of DTS comes from its emotional storytelling, which helps convert casual viewers into committed fans. The findings confirm all these studies: positive emotions directly lead to positive engagement. What is especially important is that C1 shows no gender difference. This contradicts studies such as Kol and Levy (2023), who argue that women process emotional information differently, and Pope (2017), who describes sports fandom as traditionally male. In this configuration, men and women react the same way. When emotional tone is high, emotion becomes a universal driver, overriding demographic differences.

Configuration C2 explains negative sentiment when both emotional tone and representation are absent. In this situation, fans are much more likely to express negative feelings toward F1. This aligns with research showing that a lack of representation can harm female engagement. Fenton et al. (2023) and Doehler (2024) highlight how women often feel

marginalized in male-dominated sports spaces, which can lead to disengagement or self-censorship. Lick et al. (2024) also show that hostile environments and a lack of inclusion reduce participation. Toffoletti (2017) argues that when women are not represented, it reinforces the idea that sport is not for them. The results partially confirm these findings: when representation is missing and emotions are low, negative reactions increase. However, this configuration also reveals an important contradiction. Based on the literature, representation was expected to be a major driver of positive engagement. Instead, representation does not appear in the positive pathway (C1). It only matters when emotional tone is already low. This suggests that representation alone cannot create positive sentiment. It only becomes relevant when the emotional connection is weak. In other words, representation can reduce negativity, but it cannot necessarily generate positivity on its own.

Configuration C3 identifies a second pathway to negative sentiment, but this one applies only to male fans. This configuration appears when emotional tone, brand mentions, and content expectations are all absent. In this situation, male fans are more likely than female fans to express negative feelings. This aligns with studies showing that men often engage with sports through technical, informational, or brand-related content. Chiu and Leng (2021) found that male spectators at the F1 Singapore Grand Prix focused heavily on race-related themes. Toffoletti (2017) also notes that men are often motivated by the sport itself and the acquisition of technical knowledge. Sveinson and Hoeber (2015) describe male fans as authentic fans because they prioritize information and expertise. When these elements are missing, and there is no emotional tone to compensate, male fans express more negativity. Importantly, C3 is the only configuration where gender plays a role. This challenges the idea that gender differences are constant across all aspects of sports fandom. Many authors like Chiu and Leng (2021) and Kol and Levy (2023) suggest that men and women have fundamentally different motivations, but my results show that their reactions are actually very similar in most situations. Gender only becomes relevant in a very specific low-emotion, low-information context.

Across all configurations, emotional tone is the strongest and most consistent predictor of fan sentiment. A positive emotional tone is the only condition that is both necessary and sufficient for high feeling. Other variables such representation, brand mentions, and content expectations, only influence negative pathways when emotional tone is absent. Gender differences are minimal, appearing only in one specific configuration. These findings refine existing literature by showing that emotions act as a universal driver of engagement, capable of overriding traditional demographic divisions in the modern F1 environment.

At a broader level, the results of this study highlight the central role of emotions in shaping how fans experience F1. This finding fits well with major marketing theories that describe consumer engagement as a mix of cognitive, behavioral, and emotional (affective) dimensions (Hollebeek & Chen, 2014). Engagement is not just about consuming content. It is about forming an emotional connection with a brand, and it goes beyond simple content consumption (Hollebeek & Chen, 2014). The finding that emotional tone is the only necessary condition for positive sentiment reflects what Dessart et al. (2015) call affective engagement, meaning the strong and lasting feelings that consumers develop toward a brand. Because F1 is a hedonic product, fans naturally seek excitement, thrill, and joy (Jones et al., 2019). The fact that emotional tone alone can generate positive sentiment confirms that fans respond most strongly to content that triggers these feelings.

This also validates F1's recent shift toward emotional storytelling. Modern marketing increasingly relies on emotional appeals to influence how consumers react and share content (Tanaltay et al., 2025). The success of DTS illustrates this perfectly. As Shah and Williams (2024) explain, the series focuses on personalities, rivalries, and human stories rather than technical details. By doing so, it creates emotional connections that turn casual viewers into committed fans. My results confirm that this strategy works: emotions are the strongest driver of positive engagement across the entire fan base.

Another important insight from this study is that men and women respond very similarly to emotional content. This aligns with recent marketing research showing that emotional reactions to brand messages often remain stable across genders. For example, Robertson and Davidson (2013) found that emotional responses to advertisements were consistent even when the gender of the characters changed. Dwivedi et al. (2021) also emphasize that positive emotions are a powerful engagement tool that works across demographic groups. These findings challenge older academic models that assumed men and women process information in fundamentally different ways. The selectivity hypothesis, for example, argued that women rely more on detailed emotional processing while men focus on simpler cues (Meyers-Levy, 1988). The csqca results show the opposite: when emotional tone is positive, both men and women express the same positive feeling. This suggests that affective engagement functions as a shared emotional language in the modern F1 environment.

These results also help move beyond traditional gender stereotypes in sports fandom. Historically, sport was described as a male preserve, where men were seen as authentic fans and women were viewed as outsiders or passive spectators (Fenton et al., 2023). Some studies even suggested that women were mainly interested in social aspects or the appearance of

athletes (Chiu & Leng, 2021). By showing that emotional tone is the primary driver of sentiment for all fans, this study challenges these outdated assumptions. It suggests that the modern F1 experience is a shared emotional journey, not a gendered one.

Findings show that emotional tone is not only important within each configuration but also the main element that shapes how fans react to F1 content overall. At the micro level, emotions decide whether fans respond positively or negatively. While other factors such as representation, brand mentions, or content expectations, only matter when emotional tone is missing. At the macro level, this pattern supports broader theories of affective engagement and shows that emotional reactions work in similar ways across different groups of fans. By showing that emotions can override traditional differences such as gender, this study helps build a more unified view of sports fandom in digital spaces. It also challenges earlier assumptions that representation or informational content would be the main drivers of sentiment. Instead, the findings suggest that emotional connection is the base on which all of the other forms of engagement depend.

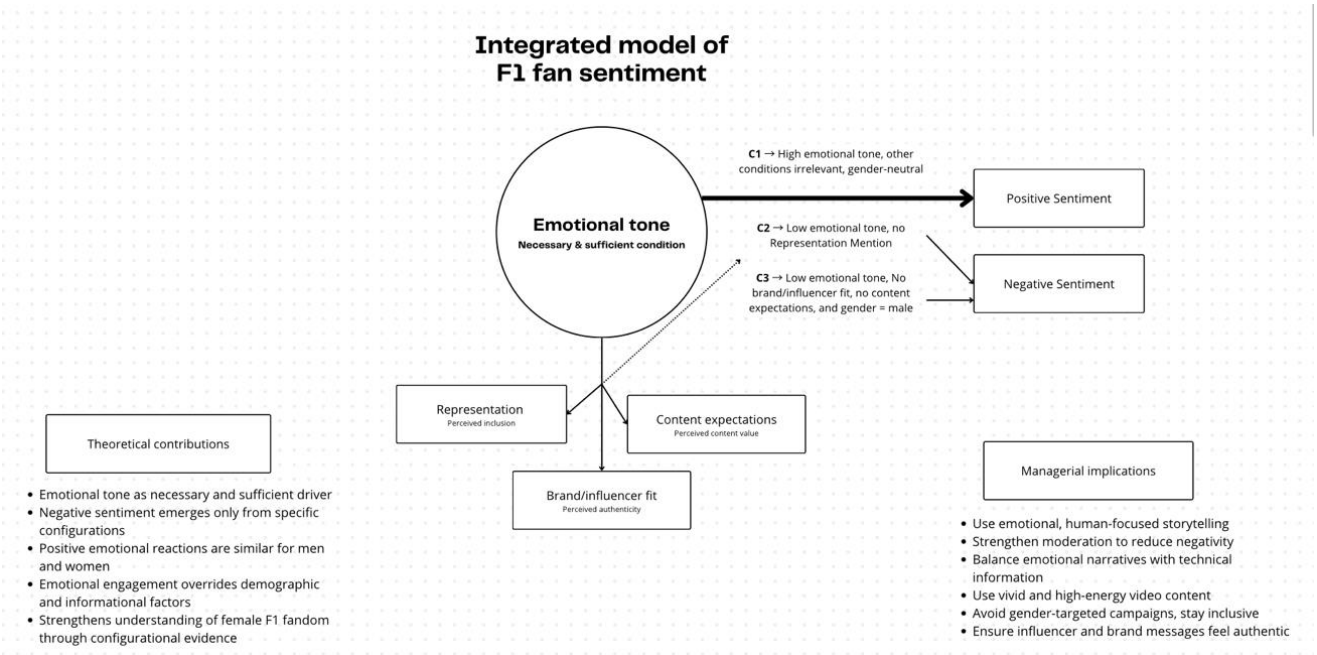


Figure 2: Integrated model of F1 fan sentiment

6. Conclusion and final considerations

6.1. Conclusion

This dissertation examined how emotional and informational cues shape fan sentiment toward F1. By analysing 5 000 comments with a configurational method, the study captured the complexity of online reactions. It also showed how different conditions combine to influence sentiment. This approach made it possible to move beyond simple positive–negative classifications. It helped understanding the specific pathways that lead to different outcomes. The results show that emotional tone is the central element driving fan responses. When emotional tone is positive, fans react positively even when representation, brand mentions, or content expectations vary. When emotional tone is absent or negative, the other variables become more influential and can contribute to negative reactions. These findings confirm that emotional expression is the main mechanism that is shaping engagement in F1's digital communities. The findings also confirm that fans respond strongly to content that conveys clear emotional cues.

The study also demonstrates the value of using a crisp-set qualitative comparative analysis in sports marketing research. This method allowed the identification of multiple pathways leading to the same outcome. It is particularly relevant in digital environments where fan behavior is diverse and context-dependent. It also revealed patterns that more traditional approaches might overlook, such as the limited role of representation or brand mentions when emotional tone is already positive. By applying this method to a large set of online comments, the research shows how digital fan behavior can be studied in a structured and systematic way, while still capturing the complexity of real interactions.

In conclusion, this dissertation highlights the importance of emotional storytelling and inclusive communication in a sport that continues to expand its global audience. The results show that fans respond most strongly to content that expresses excitement, joy, empathy, or other positive emotions. For F1, this means that digital strategies built around human-centred narratives, behind-the-scenes moments, and emotional clarity are more likely to generate stronger engagement. As the sport grows and attracts more diverse publics, understanding emotional behavior becomes essential for teams, brands, and organizers who want to build lasting relationships with fans. The findings offer a clear foundation for future work and open new paths for studying how emotions shape engagement in modern sports environments, especially in a fast-moving and highly visible ecosystem like F1.

6.2. Practical considerations

This study offers several practical insights for F1, its teams, and marketing managers. The results show that emotional tone is the strongest driver of positive sentiment, and this has clear implications for content strategy, community management, and audience segmentation.

Firstly, because emotional tone is the only condition that is both necessary and sufficient for positive sentiment, F1 should continue to invest in content that highlights human stories. Character-driven narratives, rivalries, and behind-the-scenes moments help create emotional connections that appeal to all fans. This aligns with Soble and Lowes (2024), who show that DTS succeeds because it focuses on personalities rather than technical details. Emotional storytelling remains the most effective tool for converting casual viewers into committed fans.

Secondly, the results show that negativity increases when emotional tone and representation are both absent (C2). This confirms earlier research showing that hostile online environments push women to self-censor or withdraw (Lick et al., 2024; Fenton et al., 2023). To address this, F1 should adopt stronger moderation practices. This includes filtering hate speech, banning repeat offenders, and increasing proactive moderation during posts that involve representation or sensitive topics. These actions help protect vulnerable fan segments and reduce disengagement.

Thirdly, the male-specific negative pathway (C3) shows that male fans react negatively when emotional tone, brand mentions, and content expectations are all missing. This means that technical content such as race strategy, engineering details, and performance analysis, must remain accessible. This recommendation is supported by Shah & Williams (2024), who note that F1 risks alienating its traditional fanbase who value technical accuracy, if it focuses only on dramatized narratives. While dramatization helps to attract new audiences, those with a deeper and more technical knowledge might become frustrated if the narrative arcs only focus on entertainment. Therefore, teams and marketers should strategically balance emotional storytelling with clear informational anchors. This prevents alienating long-time fans who value expertise and authenticity.

Additionally, research shows that vivid content, especially video, increases sharing and emotional activation (Annamalai et al., 2021). Marketing teams should use short-form videos, driver reactions, and high-energy race clips to capture attention (Kol & Levy, 2023). These formats stimulate sensory engagement, which helps emotional engagement take over. This approach is especially effective on platforms like Instagram, TikTok, and X.

Lastly, since men and women respond similarly to positive emotional tone, gender-targeted marketing is not necessary (Robertson & Davidson 2013). F1 should avoid stereotypical pink or female-focused campaigns, which can feel patronizing (Sveinson et al., 2019). Instead, the sport should focus on inclusive emotional narratives that appeal to all fans equally. This aligns with modern inclusive marketing principles and supports a unified fan community (Shah & Williams, 2024; Soble & Lowes, 2024).

In conclusion, the findings suggest that the future of F1 fandom lies in emotion-driven, inclusive, and balanced digital engagement. By understanding how emotional tone shapes fan reactions, F1 and its partners can design strategies that appeal to a diverse global audience. These insights open the door for future research on emotional dynamics in sports communities and the evolving role of digital storytelling in global fan cultures.

6.3. Theoretical considerations

This study advances key debates on sports fandom, digital engagement, and gender by showing how emotional tone shapes fan sentiment in F1. Pope (2017) explains feminization as the growing presence and visibility of women in sports spaces that were traditionally male. The findings refine this idea by showing that feminization is also an emotional shift, not only a demographic one. Emotional tone is the only condition that is both necessary and sufficient for positive sentiment, and it works the same way for men and women. This means emotional tone acts as a universal language across genders. Emotional engagement acts as a gender-neutral mechanism in F1's digital communities. These results challenge the idea that men and women engage with sports content for fundamentally different reasons (Doehler, 2024) and suggest that modern fandom is shaped by shared emotional experiences rather than gendered motivations.

The social learning theory created by Bandura (1977) suggests that fans acquire behaviors, attitudes, as well as knowledge, through observation, modelling, and media exposure. Previous research on DTS argues that fans learn technical knowledge through narrative storytelling (Soble & Lowes, 2024; Shah & Williams, 2024). The findings extend this by showing that emotions are the primer that makes learning possible. Without emotional tone, cognitive engagement such as understanding technical details or brand information is weaker. This means that in modern F1 fandom, affective activation comes before cognitive processing. It adds a new layer to how social learning theory applies in digital sports environments.

Engagement theory proposes three dimensions: cognitive, affective, and behavioral (Hollebeek & Chen, 2014). Previous studies often treat these dimensions as equally important.

In this study, the csqca results show that this is not the case in F1. The affective dimension dominates, as emotional tone is both necessary and sufficient for positive sentiment. Cognitive and behavioral cues only matter when affect is absent. This finding refines the model by showing that in hedonic sports consumption, affect is the core driver, and other dimensions play a secondary role.

Finally, this study challenges the selectivity hypothesis (Meyers-Levy, 1988), which argues that men and women process emotional information differently. In the positive pathway, emotional tone produces the same reaction across genders, showing that strong emotional narratives can override traditional gendered processing patterns. Gender appears only in one narrow negative configuration, where emotional tone and informational cues are missing. This supports recent research questioning long-standing gender stereotypes in sport and digital media and shows that modern fandom is increasingly defined by shared affective responses rather than demographic divides.

6.4. Future research and limitations

This study has several limitations that open useful directions for future research. The analysis focused only on comments written in English and French. It means that the emotional behavior of fans from other linguistic and cultural backgrounds may not be fully represented. F1 has a global audience, and emotional expression varies widely across countries, cultures, as well as communication styles. Including comments in more languages would allow future studies to capture a broader and more accurate picture of fan sentiment. It would also allow to identify cultural differences in how fans react to F1 content.

Another limitation concerns the identification of gender. Because gender was identified from public profiles, the accuracy of this information cannot be guaranteed. Many users choose neutral usernames or profile pictures that do not reflect their real identity. This reduces the reliability of gender-related patterns in the results. It might hide important differences in how various groups experience the sport. Future research would benefit from self-reported demographic data or survey-based methods that allow for more precise gender identification and a deeper understanding of how different groups experience with the sport.

The use of binary coding also creates limitations. Csqca requires variables to be coded as 0 or 1, but this simplifies emotional expressions that are often more complex. Emotions in sports can be mixed, contradictory, or expressed with different intensities. Reducing them to simple categories may hide important nuances. Future studies could use more advanced tools,

such as multi-emotion sentiment analysis or natural language processing models. This would allow to capture a wider range of emotional reactions and provide a more detailed view of fan behavior.

The study also relied only on Instagram and X. These platforms encourage short and reactive comments and attract specific types of users. This means that they do not represent the full diversity of F1 fans. They also do not capture longer conversations or more detailed discussions. Including platforms such as TikTok, YouTube, Reddit, or Discord would allow future research to compare emotional patterns across different online spaces and communication styles. This would help identify whether certain emotional cues are platform-specific or consistent across the F1 ecosystem.

Another limitation relates to timing. The dataset reflects fan sentiment at one moment in time. However, emotions in F1 can change quickly depending on race results, controversies, or even major announcements. A single snapshot cannot capture these fluctuations. Longitudinal research conducted across an entire season or over several seasons would provide valuable insight into how emotional tone evolves throughout the year. It would also provide insights into how fans respond to different sporting and media events.

Finally, the study is based only on public comments, which represent the most visible and vocal part of the fan base. Many fans do not comment at all even though they actively follow the sport. These silent or less active fans may experience emotions differently and may have different expectations of F1 content. Future research could include surveys, interviews, or other methods to better understand the reactions of fans who do not participate publicly. This would help build a more complete picture of the emotional landscape of F1's audience.

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8. Annexes

Annex A- Analysis of necessary conditions and intermediate solutions (csqca output)

Analysis of necessary conditions

Outcome variable: Feeling

Conditions tested:

	Consistency	**Coverage**
Emotional	0.995306	0.997861
Representation	0.143589	0.981050
Brand	0.538724	0.956077
Content	0.218263	0.923285
Gender	0.353318	0.923285

Outcome variable: ~Feeling

Conditions tested:

	Consistency	**Consistency**
~Emotional	0.967320	0.930818
~Representation	0.957516	0.068029
~Brand	0.620915	0.080782
~Content	0.722222	0.056885
~Gender	0.591503	0.056351

Truth table analysis

Intermediate solution

Frequency cutoff: 14

Consistency cutoff: 0.992629

Assumptions:

	Raw coverage	**Unique coverage**	**Consistency**
Emotional	0.995306	0.995306	0.997861

Solution coverage: 0.995306

Solution consistency: 0.997861

Truth table analysis

Complex solution

Frequency cutoff: 5

Consistency cutoff: 0.8

Assumptions:

	Raw coverage	**Unique coverage**	**Consistency**
~Emotional*~Representation	0.924837	0.79085	0.930921
~Emotional*~Brand*~Content*Gender	0.147059	0.0130719	0.957447

Solution coverage: 0.937908

Solution consistency: 0.928803

Annex B- Configurations for high and low feeling (csqra results)

	High Feeling	**Low Feeling**	
	C1	**C2**	**C3**
Emotional	●	○	○
Representation		○	
Brand			○
Content			○
Gender			●
Raw Coverage	0.995	0.925	0.147
Unique Coverage	0.995	0.791	0.013
Consistency	0.998	0.931	0.957
Solution coverage	0.995	0.937	
Solution consistency	0.998	0.929	

Annex C- Coding guide for data collection tool

Comment ID	Platform	Account name	Post type	Comment date	Comment text
C001	Instagram	Ferrari	Race-related	YYYY-MM-DD	(Full comment) raw qualitative data
C002…	X	Mercedes	Driver storytelling		
		Mclaren	Lifestyle and Behind-the-scenes		
		Redbull	Sponsorship - Brand Collaboration		
		F1	Entertainment - Emotional content		

Emotional tone	Feeling toward F1	Representation mention	Brand or influencer mention	Content expectation	Gender
0= Negative emotional tone	0 = Negative feeling toward Formula 1	0 = No mention of representation or inclusion	0 = No mention	0= No expectation expressed	F = Female
1 = Positive emotional tone	1 = Positive feeling toward Formula 1	1 = Mention of inclusion, exclusion, gender, community welcome, sexism etc	1 = Mention present	1 = Expectation expressed	M = Male
					0 = Unknown

Annex D- Abstract of data collection

Comment ID	Platform	Account name	Post type	Comment date	Comment Text
C001	Instagram	F1	Driver storytelling	30/01/2026	Dreaming of the day we will see her as an F1 driver ♡
C002	Instagram	F1	Driver storytelling	30/01/2026	Yesssss love to see it. More women drivers yes yes yes !
C003	Instagram	F1	Driver storytelling	31/01/2026	we are so endlessly proud of you @dorianepin 💝
C004	Instagram	F1	Driver storytelling	30/01/2026	I'm excited to see Doriane in F1 ???
C005	Instagram	F1	Driver storytelling	30/01/2026	She looks like a 'girl version' of George Russell 😁
C006	Instagram	F1	Driver storytelling	31/01/2026	👏Congratulations, this is fantastic news for women drivers out there trying to make their way into a (what was) mans world 👍👌
C007	Instagram	F1	Driver storytelling	31/01/2026	Love to see more women😍😍
C008	Instagram	F1	Driver storytelling	31/01/2026	t's really funny that everyone thinks they will ever reach F1. They won't 😅
C009	Instagram	F1	Driver storytelling	30/01/2026	Absolutely deserved!! 😇👍
C010	Instagram	F1	Driver storytelling	31/01/2026	Who is Doriane Pin? Literally our queen of racing!!! ♡🔥

Emotional tone	Feeling toward F1	Representation mention	Brand or influencer mention	Content expectation	Gender
1	1	0	1	0	F
1	1	1	0	1	F
1	1	0	1	0	F
1	1	0	1	0	F
0	1	0	1	0	M
1	1	1	0	0	F
1	1	1	0	1	F
0	0	0	0	0	M
1	1	0	0	0	M
1	1	1	1	0	F