






RESEARCH ARTICLE

Us versus them mentality in football fans: Significant social defeat engages the mentalization network and disengages cognitive control areas [version 1; peer review: awaiting peer review]

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Abstract

Background: Social affiliation is one of the building blocks that shapes cultures and communities. This motivation contributes to the development of social bonding among individuals within a group, enjoying rights, assuming obligations, and strengthening its identity. Evidence has shown that social affiliation has inspired different social phenomena, such as wars, political movements, social struggles, among others, based on two human motivations: the ingroup love and the outgroup hate. One contemporary group to study as a proxy of social affiliation, and ingroup and outgroup motivations is the sports competition. However, this affiliation model has been poorly considered in social neuroscience research. This research aimed to shed light on the neurobiological networks that are related to social affiliation in football fans of two of the most popular Chilean football teams.

Methods: To this end, 43 male fans of two football rival teams watched videos of winning and losing goals of their favorite team while their brain activity was measured with functional magnetic resonance imaging (fMRI).

Results: The results showed that while the activation of the reward system was observed in fans when their team scores goals against the

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rival, both the activation of the mentalization network and the inhibition of the dorsal anterior cingulate cortex were associated with the emotional correlates of defeat in football fans.

Conclusions: Taking these findings together could contribute to a deeper understanding of social affiliation, and more importantly, of extreme affiliation phenomena, and fanaticism.

Keywords

Social Affiliation, Football, Cognitive Control, Mentalizing, dACC, Identity



This article is included in the [Social Psychology](#) gateway.

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Introduction

The social nature of human beings is evidenced in different complex social phenomena, such as social identification, altruism, social affiliation, ingroup favoritism, out-group bias, among others.¹⁻⁷ It has been raised that the formation of complex social relationships has enabled the emergence of social cohesion and group identities, from which individuals can obtain material, symbolic and emotional benefits.^{8,9} Although there is consensus that social complexities have intercultural consistency, the neurobiological study of affiliation in different social environments has recently started.

Social affiliation is a key aspect of complex social phenomena and allows a single subject to become part of a group, assuming obligations and enjoying rights.¹⁰ Although living in a group concedes benefits, such as protection or resources, it creates the scenario for the development of out-group competition. From a psychological perspective, there are two mental mechanisms that interact to explain social affiliation and out-group conflict: The “in-group love”, in which individuals from the same group are willing to benefit from, and treat more favorably their in-group members, and on the contrary, the “out-group hate”, in which people are motivated to either increase the gap between the groups or to compete and hurt their out-group members.^{1,11,12} In fact, they have proposed that in-group biases and out-group hostility have co-evolved.¹¹ Although there is strong behavioral evidence in favor of in-group and out-group mechanisms, there is little evidence about the presence of a neurobiological substrate that can support these mental mechanisms.

Another person’s misfortune could give pleasure especially if he/she is a member of a rival group.¹³ This phenomenon known as *schadenfreude* correlates with both the likelihood to harm those rivals² and striatal activation, especially when the other person is advantaged.¹³ Moreover, group identification and competitive context have been described as elements that facilitate *schadenfreude*.² These social motivations have shed light on the study of empathy, and how empathic responses can diminish and become rare in these situations when social relationships and competition are involved.¹⁴ Interestingly, the sharing of others’ emotions, regardless of whether it is a positive or negative emotion³⁻⁵ can also be determined on the basis of group membership.¹⁵ This phenomenon, known as intergroup empathy, refers to the likelihood of being more willing to share the feelings of an ingroup member than an outgroup person.¹⁵⁻¹⁷

In addition, the ability to identify or understand another’s situation or feelings also requires another crucial ability, the capacity of reasoning about others’ emotions and thoughts. This ability, known as Theory of Mind (ToM) or mentalization, encompasses the capacity to interpret and make inferences about other people’s intentions and feelings.^{7,18,19} Socio-affective processes and successful social interactions require both empathy and ToM. While they are closely related, neuroimaging evidence has described different brain areas that subserved for each one.^{3-6,20} The empathy-related brain network comprises the anterior insula (AI), the anterior cingulate cortex (ACC), the supramarginal gyrus (SMG), and the dorsolateral prefrontal cortex (dlPFC). The ToM-related brain network comprises the temporoparietal junction (TPJ), the posterior superior temporal sulcus (pSTS), the dorsomedial prefrontal cortex (dmPFC), the precuneus (PCu), the temporal pole, and the inferior frontal gyrus (IFG).

In this context, one of the most interesting contemporary groups to study as a proxy of social affiliation, and ingroup and outgroup motivations are sports competitions. This kind of context can be an ecological model of affiliation, in which rivalries between fans with affiliation to different teams can be studied. These enmities often generate conflicting phenomena. Nevertheless, this affiliation model has been poorly considered in social neuroscience research.

Among the different sports, football is a model of strong social affiliation. Currently, football is one of the most popular crowd-gathering sports.²¹ Football fans develop degrees of identification with their teams and organize themselves to follow the team’s performance to which they emotionally feel close to. It is well-known that professional football teams can develop a strong identity due to their link with the territory, history, and culture to which they belong and the symbols they reproduce.²²

The unexpected victory of Uruguay over Brazil in the final game of the FIFA Football World Cup of 1950, known as “The Maracanazo”, is perhaps an extreme example of the strong social affiliation existing among football fans and its potential consequences. While the world continued its post-war reconstruction, the Maracanã Stadium was overflowed with more than 200,000 people in the stands. The final between Brazil and Uruguay was played in a scene of celebration. In the previous speech, the authorities congratulated the champion before playing, while outside the stadium, there was a real carnival. Everything was planned, except for one thing: Uruguay won. The dismay was so profound that heart attacks, mass suicides, and a huge generalized sadness in the Brazilian fans were reported after losing the world final.²³

While it is true that these kinds of reactions can take place, it is also true that there is a broad range of adaptive behaviors that allows compensation in such stressful situations, for example, when football fans have to face defeat. Despite these behavioral differences, a person who maintains an affective bond with a football team experiences emotions around

victory and the defeat of the enemy team, which have been related to the reward brain network.^{21,24–26} Evidence has described that both cortical and subcortical circuits are involved in winning and losing. Regarding cortical networks, the orbitofrontal cortex (OFC), the anterior cingulate cortex (ACC), and the insula have been associated with rewarding experiences, as well as subcortical structures such as the nucleus accumbens (NAcc), ventral pallidum (VP), the amygdala (AMY), and the ventral tegmental area (VTA). On the other hand, in the defeat context, there are different behaviors which would respond to mechanisms that encourage the maintenance and/or alteration of self-control. These states are susceptible not only to the game result but also to particular events of the game, which means that a fan can develop several emotional states during a single game. Given this changing context, emotional and behavioral control is a dynamic process, which is constantly challenged by the particular situations of the game, such as frustration, aggression, or even cheating.

Taking this evidence together, we hypothesized that victory and defeat in different contexts of social affiliation modulate the neurobiological mechanisms underlying cognitive control in football fans. We aimed to characterize the neurobiological networks that are related to the emotional response to positive, negative, and neutral valence stimuli, while football fans watched videos of winning and losing goals of their favorite team. A total of 43 male fans of the two most famous football teams in Chile, “Colo-Colo” and the “Universidad de Chile”, viewed football goals while undergoing functional magnetic resonance imaging (fMRI) (29 “spectators”, 13 “supporters”, one “fanatic”).²⁷

Our results show that while the activation of the reward system was observed for the significant victory, both the activation of the mentalization network and the inhibition of the dorsal ACC were associated with the emotional correlates of the defeat in football fans.

Methods

Participants

Recent literature^{27,28} classifies football fans as “spectators”, “supporters”, and “fanatics”. The “spectators” (“viewers”), are focusing on enjoying the sports show, live or on television, and they can be distinguished by getting involved in the match in a regulated manner. The “supporters” show a higher degree of commitment to their team and become strongly involved with the performance and with the result of their team. They often attend the stadium much more frequently than the “spectators”. Finally, the “fanatics” are those who build a main part of their own social identity around the club, attending almost every game.

A total of 43 healthy male volunteers (34 ± 8.13 years old) supporters of one of the two most popular Chilean football teams were recruited for this study. A total of 22 supporters of the Colo-Colo (CC) team and 21 supporters of the Universidad de Chile (UCh) team. According to the football supporters fanaticism scale,²⁷ 29 of them were listed as spectators (15 for CC and 14 for UCh), 13 as fans (6 for CC and 7 for UCh), and one as an extreme fan (for CC).

Procedure

Participants underwent the “Football Supporters Fanaticism Scale” [FSFS]²⁷ prior to fMRI examination. Then, participants were prepared for the MRI and were instructed to relax and keep still during image acquisition.

Stimuli

Subjects watched a football video compilation consisting of 63 goals. Each video had a duration ranging from 20 to 30 seconds. The total task duration was 26 minutes and 40 seconds. The stimulus consisted of goals from the CC to the UCh teams, from the CC team to other teams, from the UCh to the CC teams, from the UCh team to other teams, from other teams to both the CC and the UCh teams, and others teams between them. Taking advantage of the rivalry between the CC and the UCh teams, the videos were classified for each subject in the following categories: Fan→Riv (where the supported team score against the rival), Fan→Other (where the supported team scored against other teams different from the rival), Riv→Fan (where the rival team scored against the supported team), Other→Fan (where other teams different from the rival scored against the supported team).

To simplify, from now on, we will refer to significant victory (SV) as the contrast of conditions (Fan → Rival) minus (Fan → Other), and Significant Defeat (SD) as the contrast of conditions (Rival → Fan > Other → Fan). See [Figure 1](#).

Data acquisition and analysis

Due to the large number of images acquired during the presentation of the goals compact presented to the participants, and due to the possibility of artefacts generated during the acquisition of the images, we ran ICA-AROMA for each data set to automatically de-noise fMRI data.²⁹ fMRI imaging was conducted as previously described in Kausel *et al.*³⁰ Finally, following the recent MRI analysis guidelines,³¹ reported results were based on an initial uncorrected voxel-level threshold of $z > 3.1$ and cluster inference using a familywise error-corrected threshold of $p < 0.05$.

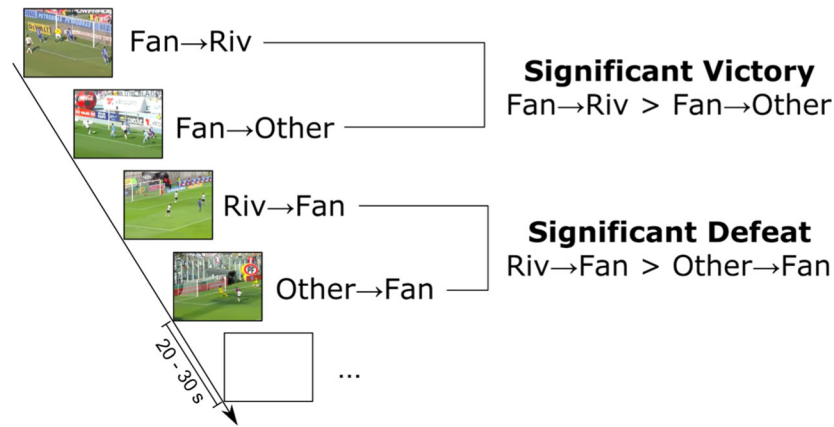


Figure 1. Schematic representation of the task and generation of contrasts of interest. SV for significant victory and SD for significant defeat.

Fanaticism scale correlations

To test for a correlation between FSFS and BOLD changes during a SD, we conducted a robust regression and a Spearman partial correlation. We used the inverse of the score (-1*FSFS) to intuitively present the result (*i.e.*, a greater score indicated more fanaticism). We used the t-value for the corresponding contrast per subject using a spatial mask for the mentalizing network and dACC extracted from **Neurosynth**. We used the term “mentalizing” for the mentalizing network, and for dorsal ACC, we used the term “dACC”. For both, we set a threshold of $q < 0.01$ (FDR, association test) and removed clusters smaller than 15 voxels.

Results

Functional magnetic resonance results

SV contrast shows activations lateralized to the right in the frontal and parietal areas. Activation was observed in the bilateral fusiform face area (FFA). In addition, activation of components of the empathy network in the fronto-central circuit was also observed. Moreover, activation was observed in the ventral striatum (VS), caudate, and lentiform nucleus (putamen + pallidum). Notice, the VS is a critical component of the dopaminergic reward circuit, which is also associated with pleasant experiences and learning processes. Together, these results suggest that when the participant is watching his team beat the archrival, a bottom-up reaction is generated, that is, an emotional state that carries out the in-group love effect improving social cohesion. See **Table 1**.

Table 1. Regions activation for significant victory (SV) contrast (Fan→Rival > Fan→Other).

Z value	x	y	z	Brain regions
6.43	10	-92	-2	right occipital pole
5.77	2	-90	-14	lingual gyrus, occipital lobe
5.66	8	-74	-8	lingual gyrus, occipital lobe
5.53	-8	-4	-6	ventral striatum/Pallidum
5.44	24	-36	-18	fusiform and parahippocampal gyrus
5.32	-4	-98	-2	left occipital pole
5.17	-4	4	68	frontal lobe/supplementary motor cortex
4.88	6	20	64	right superior frontal gyrus
4.7	6	10	64	right superior frontal gyrus
4.58	-4	10	70	left superior frontal gyrus
4.56	-6	16	54	left superior frontal gyrus
4.89	-2	56	8	medial frontal PFC/paracingulate gyrus
4.19	2	52	32	right superior frontal gyrus
4.11	2	52	36	right superior frontal gyrus
3.99	-4	48	36	left superior frontal gyrus

Table 1. *Continued*

Z value	x	y	z	Brain regions
3.98	8	54	-2	right paracingulate gyrus
3.97	4	60	22	right frontal pole
4.27	-48	26	-10	left inferior frontal gyrus
4.1	-48	20	8	left inferior frontal gyrus
4.55	-58	-52	28	left supramarginal gyrus
3.71	-60	-42	24	left supramarginal gyrus
4.86	-18	-38	-18	left parahippocampal cortex
4.78	-20	-42	-16	left parahippocampal cortex
4.13	54	32	-2	right inferior frontal gyrus
3.86	56	38	-2	right inferior frontal gyrus
3.39	56	12	-10	right temporal pole
3.31	54	12	-6	right temporal pole
3.95	-14	-54	16	precuneus, left cortex
3.92	-2	-60	52	precuneus, left cortex

Significant defeat contrast shows a canonical activation pattern of the mentalizing network, which includes the superior temporal sulcus (STS), the OFC, the dIPFC, the PCu, and the inferior frontal junction (IFJ). Also, there was an activation of the FFA, but lateralized to the left; this suggests that, in the face of victory, the homologous cortex is recruited, but in the face of defeat this does not happen. Also, activation of lobe VIIb of the cerebellum was observed, which is related to cognitive processing.^{32–34} See [Table 2](#).

Table 2. Regions activations for significant defeat (SD) contrast (Rival → Fan > Other → Fan).

Z	x	y	z	
6.78	30	-46	-12	fusiform cortex
6.77	26	-44	-12	lingual gyrus
6.41	-12	-50	-48	left 9 cerebellum
5.76	52	-20	-12	right middle temporal gyrus
5.74	-14	-76	-36	left crus II cerebellum
5.73	14	-94	-12	right occipital pole
5.89	48	18	24	inferior frontal gyrus
5.48	40	14	24	inferior frontal gyrus
4.75	42	0	48	medial frontal gyrus
4.74	46	2	48	right precentral gyrus
4.72	28	18	42	medial frontal gyrus
4.62	40	4	56	medial frontal gyrus
5.86	-48	-50	12	supramarginal gyrus
5.05	-52	-42	6	superior temporal gyrus
4.9	-58	-14	-8	left middle temporal gyrus
4.89	-64	-44	6	left middle temporal gyrus
3.9	-48	-24	2	planum temporale
5.02	6	54	-20	frontal medial cortex
4.79	0	58	-22	frontal medial cortex
4.78	6	50	30	right superior frontal gyrus

Table 2. *Continued*

Z	x	y	z	
4.42	4	62	-10	frontal pole
4.34	-2	42	-26	orbitofrontal medial cortex
4.3	6	64	6	frontal pole
4.18	-48	6	52	left middle frontal gyrus
3.93	-42	2	42	left precentral gyrus
3.91	-40	0	38	left precentral gyrus
3.83	-38	18	16	left inferior frontal gyrus
5.09	-32	-84	26	left superior lateral occipital cortex
4.73	-30	-78	40	left superior lateral occipital cortex

The negative effect of SD contrast shows inhibition of the dACC, a key region of the limbic system tightly related to the cognitive control areas, such as the dorsal and ventral frontal cortex,³⁵ which regulates the normative and adaptive behaviors.^{36,37}

To assess the relationship between the brain areas showing significant modulation in SD contrast and the individual differences in the group bias, we correlated the FSFS and the activity in selected brain areas. Following the results of the SD contrast, for the positive effect, we extracted the activity in the mentalizing network, and for the negative effect, the activity in dACC. To this end, we used a mask template from Neurosynth.³⁸ Then, we carried out a robust regression model and a partial Spearman correlation, using the FSFS as the dependent variable and negative and positive effects as independent variables. For the dACC, a negative correlation was found, indicating that the more fanatic the subject is, the greater deactivation in dACC ($\beta_{\text{robust}}=2.8$, $t_{40}=-2.0$, $p=0.04$; $\rho=-0.26$, $p=0.08$). Similarly, we found a significant positive correlation for the mentalizing network, indicating more activation while the less fanatic the subject is ($\beta_{\text{robust}}=-3.7$, $t_{40}=2.8$, $p=0.007$; $\rho=0.32$, $p=0.03$).

Discussion

The study of social phenomena that include antagonism (rivalry), can be ethically controversial, for example, when studying religions,³⁹ ethnic groups⁴⁰ or political tendencies.⁴¹ However, sports competitions such as football provide a possibility to analyze the phenomena of fans and fanaticism under significant environmental plasticity. It is noteworthy that the fanatic concept is not a synonym of “fan”. The fanatic, together with the vicarious process,⁴² implies a phenomenon of extreme affiliation that facilitates adherence to radical ideologies and finally violence. In contrast, the fan concept arose during the 1960s related to the followers of musical bands.⁴³

The foregoing is because the fans of a football team can also be fans of the national football team, matching with rivals who would otherwise be opponents. Football maintains a very strong power of affiliation, which was reflected in the words of the Uruguayan writer Eduardo Galeano: “In his life, a man can change political party or religion, but he cannot change his soccer team”.⁴⁴

Moreover, football is a sport that attracts crowds globally. The world body that governs the organization and management of the sport is the *Fédération Internationale de Football Association* (FIFA), which includes 211 associated federations, even more than those associated with the United Nations (193). The high level of uniformity in terms of regulations and the principles that structure the game makes football a global and homogeneous practice, which, added to the high levels of fidelity on the part of fans, makes this an interesting field to study the phenomenon of human social affiliation.

The results presented here confirm our hypothesis that the activations/inhibitions of brain circuits differ depending on whether it is a positive or negative valence stimulus, *i.e.* whether a fan’s team scores or concedes a goal (Figure 2). This is further exacerbated when this happens against the archrival team. Firstly, scoring goals against the archrival causes an activation of the reward system, specifically in the nigrostriatal dopaminergic pathway, which is responsible for providing feelings of pleasure and well-being; in contrast, conceding goals to the archrival generates a double phenomenon: In one hand the mentalization network is activated. On the other hand, the cingulate cortex is deactivated in its dorsal and anterior portions. The latter has been described as a key region for connecting limbic inputs into frontal association and behavioral control regions.^{35–37,45} This differentiation, evoked from the valence of the stimulus, could be understood as a part of the affiliative phenomenon, which, according to the in-group love and out-group hate literature,

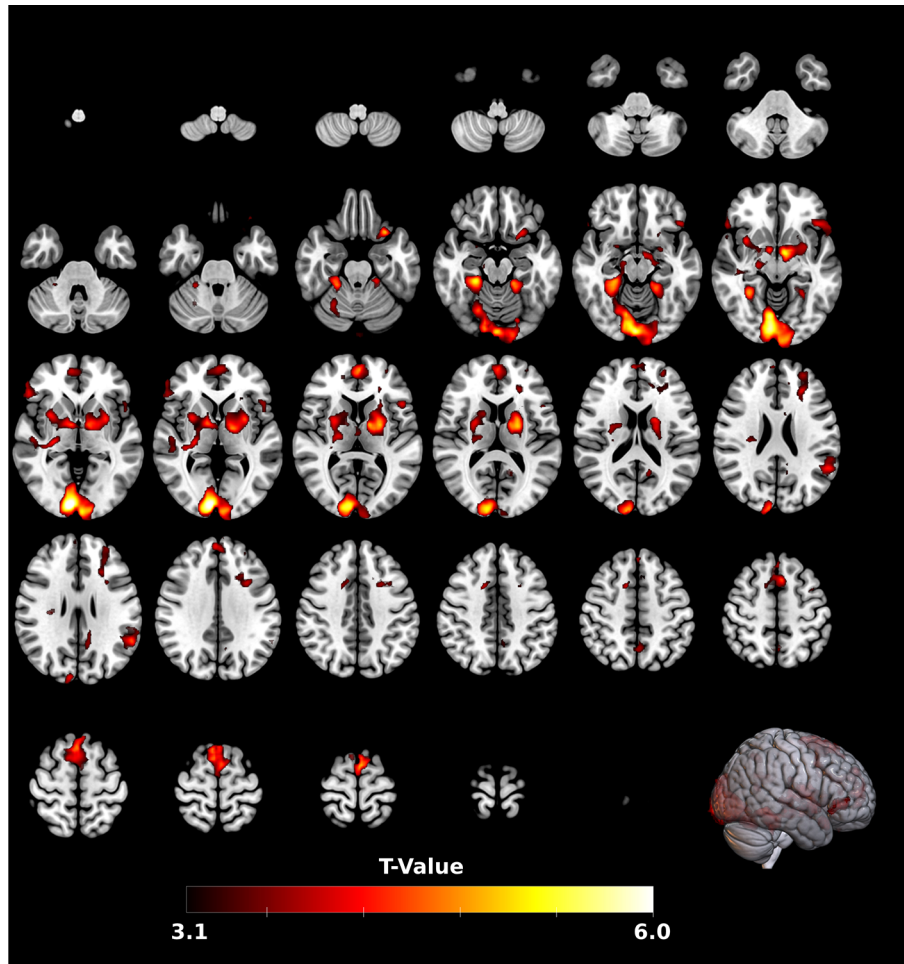


Figure 2. Significant victory (SV) contrast shows the result of the subtraction of brain activations of fans when their team scores goals against the archrival minus when they score goals against another team (Fan→Rival > Fan→Other).

manifests an emotional correlation associated with the successes and/or frustrations of the team to which the fan is affiliated. Our results show that this emotional correlation is expressed in the reward system (VS, caudate, and the lentiform nucleus) for SV, while the activation of the mentalization network (STS, OFC, dlPFC, PCu, and IFJ) (Figure 3) and the inhibition of the dACC are characteristic of the SD (Figure 4).

However, it is not only an expression of happiness when scoring and sadness when conceding goals. The activation of the dopaminergic reward circuit is associated with learning processes of behaviors that bring feelings of pleasure, transforming them into repeated behaviors,⁴⁶ such as eating,⁴⁷ having sex,⁴⁸ consuming drugs,⁴⁹ or celebrating a goal scored by your team against the archrival.⁵⁰

As we mentioned above, the dACC orchestrates the mechanism regulating the activity of ventral and dorsolateral frontal areas, involved in the establishment of cognitive control. This mechanism is inhibited when the fan's team receives a goal from the archrival, down-regulating the behavioral control and system that commands adaptive behaviors in other contexts.⁴⁵ In this direction, the activation of the mentalization network could be a substitute or compensatory control strategy against the inhibition of the dACC. This could facilitate processes of mental states attribution of third parties, that is, the search of a rational explanation that modulates the frustration of receiving a goal from the archrival avoiding the consequences of losing self-control.

Finally, these results could also be interpreted from a sociocultural framework, as the in-group love and out-group hate phenomenon is based on processes of collective identity construction and, at the same time, represents the basis of

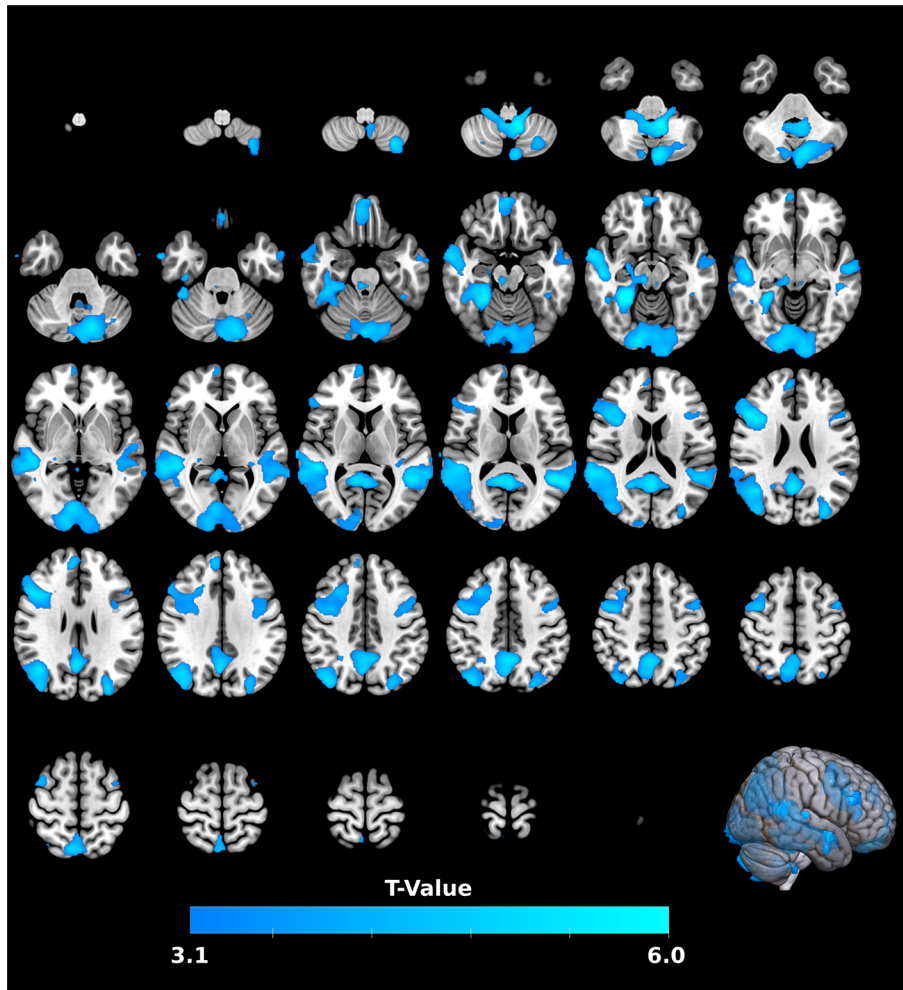


Figure 3. Shows the brain activity of football fans resulting from the subtraction of fans' brain activations when their team is defeated by the archrival team, minus when their team is defeated by other teams (Rival → Fan > Other → Fan).

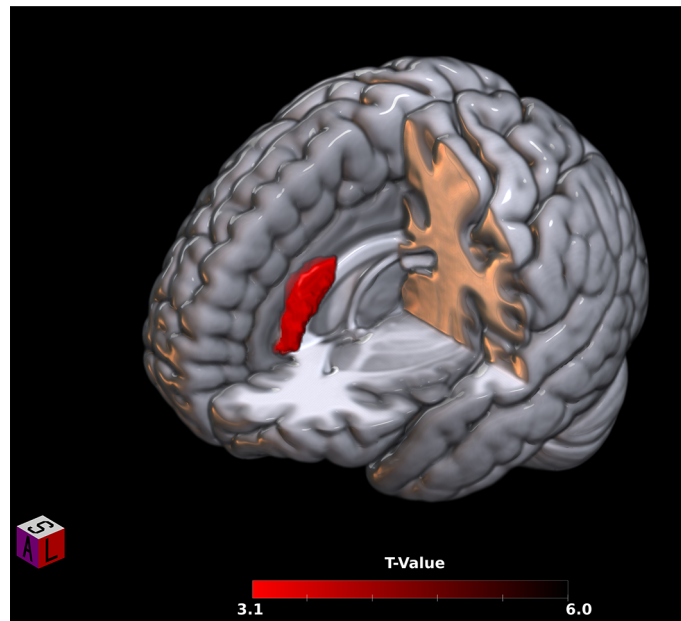


Figure 4. shows the negative effect in significant defeat (SD) contrast, depicting the areas that are deactivated during a defeat.

intergroup conflict. For fans, football teams are essential sources of identity linked to symbols, titles, and cultural and territorial roots that operate as unifying factors. For example, each major city has a “classic match” that contrasts structural value representations of society, such as socioeconomic, sociodemographic, or socio-cultural characteristics (*i.e.*, in Spain, Real Madrid versus Barcelona, in Argentina, Boca Juniors versus River Plate, in Turkey, Galatasaray versus Fenərbache). The fans feel close to these representations and build their own identities from the collective identity.

From a functional explanation, out-group competition arose to reach and monopolize limited resources. From then on, in ancestral populations, the protection or acquisition of reproductive resources were the main incentives for competition, men would be especially motivated to develop out-group competition (see “The Male Warrior Hypothesis” in McDonald *et al.*, 2012).⁵¹ Considering that the group of participants in this research included only men fans, current evidence supports this sex-specific prediction to confirm the presence of relevant biological and behavioral adaptations in men due to the presence of out-group competition. Thus, men increase out-group aggression, in-group cooperation, and out-group discrimination under a scenario of out-group threat.^{52–54} To deepen understanding of these interpretations, further research that includes women fans in the analysis is needed.

Conclusions

In the case of the Chilean football league, Colo-Colo and Universidad de Chile are the teams with the largest number of fans and titles. At the same time, they have the most numerous fans coming from socioeconomically disadvantaged sectors.⁵⁵ This relationship, which is also replicated in other parts of the world, could be explained by the evolutionary need to associate and belong to a group and thus gain access to experiencing emotions and sensations of pleasure through other people’s experiences. In this respect, the matches between the most popular clubs not only reinforce the identity of their fans but are also a source of successes and achievements that they experience as their own, which they would not be able to experience without their social affiliation.

The strength of this affiliative and identity process is shaping, in some extreme cases, a way of life, turning their affiliative behaviors into habits, rituals, and themselves into fanatics. Our results suggest that if a sports frustration such as receiving a goal from the archrival generates the inhibition of the dACC, those who lack other identity sources and place all the emotional responsibility for their own state on the result of a football match (fanatics), will become more vulnerable to their environment, being much more proclive to mass behaviors, fickle to the manifestations of violence.⁵⁶

This could help to understand how irrational phenomena take place in and around football stadiums, such as the suicides in the Maracanã stadium in Brazil in 1950, the rise of Hooligans and ultras in Europe, the existence of the “Barras Bravas” in South America and the clashes and murders that occurred in the Queretaro stadium in Mexico in 2022.

The challenge that contemporary societies face in dealing with this problem has to do with strengthening the horizon of expectations of socially disadvantaged groups in terms of facilitating access to services such as education, providing reference models when these are absent, and providing sources of identity around which these groups can diversify their cultural backgrounds. This could hinder the spread of fanaticism among citizens and avoid overloading football due to these shortcomings, allowing us to enjoy the game without losing cognitive control.

Data availability

Underlying data

Open Science Framework: Us versus them mentality in football fans: Significant social defeat engages the mentalization network and disengages cognitive control areas, <https://doi.org/10.17605/OSF.IO/47GKF>.⁵⁷

This project contains the following underlying data:

- BEHAVIOUR Raw Data
- Scripts for Behaviour
- fMRI DATA

Data are available under the terms of the [Creative Commons Attribution 4.0 International license](https://creativecommons.org/licenses/by/4.0/) (CC-BY 4.0).

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