The contribution of X to youth environmental movements addressing climate change: Effective impact or distorting noise?

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Abstract

Just Stop Oil and Last Generation have established themselves as two of the most prominent environmental activist movements, particularly in the context of the fight against climate change. Both movements have gained prominence through high-impact communication actions in both generalist legacy media and on social media. Given the significant influence and central role of the social media platform X (formerly Twitter) in promoting collective struggles and actions using hashtags, this study analyses the nature of the dialogue and the effectiveness of hashtags on the platform linked to the most controversial and subversive actions of these groups. Through an algorithmic analysis of nearly 280,000 tweets, the research characterises the main communities that have shaped the digital debate surrounding these ecological protest actions. Using social network analysis techniques, the study maps user interactions, identifies key nodes, and examines the centrality of influential actors within these conversations. Additionally, it assesses whether these actions foster meaningful engagement or, conversely, engender a polarised debate. The findings suggest that while these actions attract considerable attention, they may also contribute to a distorting effect associated with the increasingly prevalent paradigm of "climate obstructionism", by shifting the focus away from substantive climate action towards divisive public discourse.

Keywords: environmental communication; social movements; activism; Twitter; Just Stop Oil; Last Generation

Resum. *La contribució dels moviments juvenils ambientals a X per abordar el canvi climàtic: impacte efectiu o soroll distorsionador?*

Just Stop Oil i Last Generation es consoliden actualment com dos dels moviments activistes ambientals més representatius, particularment en l'àmbit de la lluita contra el canvi climàtic. Tots dos moviments han destacat per les seves accions comunicatives d'alt impacte tant en mitjans de comunicació tradicionals com en xarxes socials. Partint d'aquest context, aquest estudi planteja qüestions sobre el tipus de diàleg i l'efectivitat de les etiquetes emprades en les accions més controvertides i subversives dels dos grups a X (anteriorment Twitter), considerant l'àmplia influència i el rol fonamental d'aquesta plataforma en la promoció de lluites o accions col·lectives mitjançant l'ús d'etiquetes. A través d'una anàlisi algorítmica d'aproximadament 280.000 tuits, la recerca caracteritza les principals comunitats que han articulat el debat digital entorn d'aquestes accions ecologistes. Emprant tècniques d'Anàlisi de Xarxes Socials (AXS), l'estudi mapa les interaccions entre usuaris, identifica nodes clau i examina la centralitat dels actors influents en aquestes converses. Així mateix, s'analitza si aquestes accions fomenten un compromís significatiu o si, per contra, propicien un debat polaritzat. Les troballes suggereixen que, si bé aquestes accions atreuen una atenció considerable, també poden contribuir a un efecte distorsionador associat al cada vegada més estès paradigma de l''obstruccionisme climàtic', en desviar l'enfocament de l'acció climàtica cap a un discurs públic fragmentador.

Paraules clau: comunicació mediambiental; moviments socials; activisme; Twitter; Just Stop Oil; Last Generation

Resumen. *La contribución de los movimientos juveniles ambientales en X para abordar el cambio climático: ¿impacto efectivo o ruido distorsionador?*

Just Stop Oil y Last Generation se consolidan actualmente como dos de los movimientos activistas ambientales más representativos, particularmente en el ámbito de la lucha contra el cambio climático. Ambos movimientos han destacado por sus acciones comunicativas de alto impacto tanto en medios de comunicación tradicionales como en redes sociales. Partiendo de este contexto, este estudio plantea cuestiones sobre el tipo de diálogo y la efectividad de los hashtags empleados en las acciones más controvertidas y subversivas de ambos grupos en X (anteriormente Twitter), considerando la amplia influencia y el rol fundamental de esta plataforma en la promoción de luchas o acciones colectivas mediante el uso de hashtags. A través de un análisis algorítmico de aproximadamente 280.000 tuits, la investigación caracteriza las principales comunidades que han articulado el debate digital en torno a estas acciones ecologistas. Empleando técnicas de Análisis de Redes Sociales (ARS), el estudio mapea las interacciones entre usuarios, identifica nodos clave y examina la centralidad de los actores influyentes en dichas conversaciones. Asimismo, se analiza si estas acciones fomentan un compromiso significativo o si, por el contrario, propician un debate polarizado. Los hallazgos sugieren que, si bien estas acciones atraen una atención considerable, también pueden contribuir a un efecto distorsionador asociado al cada vez más extendido paradigma del 'obstruccionismo climático', al desviar el enfoque de la acción climática hacia un discurso público fragmentador.

Palabras clave: comunicación medioambiental; movimientos sociales; activismo; Twitter; Just Stop Oil; Last Generation

1. Introduction

Although the fight against climate change is now a widespread global movement in which the age of participants is of little relevance (Papanikolopoulos, 2023), there is no doubt that the 'millennial' generation has significantly changed the landscape of social and environmental movements in many parts of the world.

The year 2022 marked the rise of Just Stop Oil (UK) and Last Generation (Germany), two environmental collectives with a strong presence of young activists, using direct action and anti-establishment tactics, in the same way as Extinction Rebellion (France), Brandalism (Brussels) or Dernière Rénovation (France).

Just Stop Oil's actions began on 14 October 2022, when activists threw tomato soup onto Vincent van Gogh's *Sunflowers* at the National Gallery in London. A week later, another activist from the group glued himself to and threw soup on Johannes Vermeer's *Girl with a Pearl Earring* at the Barberini Museum in Potsdam. The activists were arrested but no damage was inflicted on the artworks.

Similarly, Last Generation engaged in comparable protest actions. On 23 October 2022, they threw mashed potato at Claude Monet's *Grainstacks* in Potsdam. They subsequently disrupted Shell's annual shareholders meeting in London, and in May 2023, following severe flooding in Emilia-Romagna, they covered Rome's Trevi Fountain with mud to protest the fossil fuel industry, which they linked to the climate disaster.

Socio-environmental movements often use strategies that combine art and activism – known as '*artivism*' – to pursue significant transformations in industrialised nations in order to meet environmental goals (Stammen & Meissmer, 2024), but they also apply, occasionally, other more subversive, counter-art, transformative communication principles to awareness raising and mobilisation.

In this article, we ask whether these actions can be described as digital or hashtag activism on the issue of climate change (Housley et al., 2018; Hennschen, 2019), as is the case with other social causes, the best known being the feminist hashtag activism symbolised by the popular *#MeToo* hashtag. In the words of Joseph Doolen (2020), this type of activism fosters a 'connective identity' through social media that represents a move away from the political logic of social movements that depend on strong shared identity and meaning through the process of collective action. To achieve the same aims, the logic of social media operates in loosely networked movements based on individualised contexts of youth identity, combining the participatory culture of social media with offline political participation both in public spaces and within institutional arenas.

Given the high capacity of messaging on X (Twitter) to go viral, it is worth analysing the contribution of X (Twitter) to the digital conversation around the actions of Just Stop Oil and Last Generation in protest at the climate

emergency. To do so, we carried out empirical analysis of the communities and tweets that fuel debate around the actions of both these ecological groups.

Our starting point was the premise that this type of digital activism is based on centralised communities with strong leadership, some of whom produce disinformation around the environmental struggle manifested in diverse protest tactics. It would also be interesting to specifically examine the role played in this debate by the generalist legacy media.

More specifically, this study aims to identify the user communities involved in the debate through tweets, i.e. in the digital debate on X (Twitter) arising from the direct and controversial environmental actions of Just Stop Oil and Last Generation. These tweets were identifiable and selectable through their use of hashtags and literal expressions relating to the name or denomination of both groups, as specified in the methodology section.

This study has therefore examined how the digital debate on X (Twitter) around a controversial environmental action is structured, and which communities, actors and interaction dynamics prevail within it (RQ1). Further to this, it has sought to determine whether these digital conversational dynamics can be considered an effective form of climate activism on social media, in terms of promotion or mobilisation, or the construction of collective narratives (RQ2). Finally, taking into account the media resonance and public impact of the artistic interventions carried out by Just Stop Oil and Last Generation, the study aims to analyse the role played by traditional media – including print and digital, as well as radio and television – within the communities engaged in this digital conversation, to assess their capacity to amplify or shape the debate across social networks (RQ3).

2. Environmental digital activism and social media mediatisation

Over the last few years, various studies have demanded that more attention is paid to the possibilities offered by social communication via different media and platforms for transmitting the importance of climate change to the general public, along with the need to consider it a climate emergency (Park, 2021). Starting from the importance of communication for current environmental activism (Gulliver, Fielding & Louis, 2020), this study focuses on the digital conversation generated on X (Twitter). This communication platform enables a variety of activist arguments and protests surrounding climate change and other social, political and cultural issues; hence the importance of continuing to research its uses in depth by grassroots movements and their interconnections with other social agents, including the news media.

Previous research has provided insights into how communication styles and media framing affect efforts to shift climate change behaviours, particularly on X (Twitter) (Bennett et al., 2021; Effrosynidis, Sylaios & Arampatzis, 2022; Foderaro & Gunnarsson, 2023; Yuan & Kuehl, 2023).

For almost twenty years, X/Twitter has been the perfect medium for digital activism, especially for what is known as ‘hashtag activism’, thanks to its

high level of interactive power. Hashtag activism, or the use of hashtags or discursive tags on social media, encourages 'acts of struggle' around a multitude of causes, and makes these media platforms a prime channel for inciting social debate and raising awareness of a particular cause (Xiong, Cho & Boatwright, 2019: 12).

The microblog platform X (Twitter) could be considered one of the main social media platforms for fostering 'socio-political discussion and participation' (Xiong, Cho & Boatwright, 2019: 12). It involves flexible participation through likes, shares or retweets as decisive codes of communication and exchange. As with other social media, X (Twitter) embodies a 'network media logic' which goes beyond the traditional 'media logic' and represents a clear evolution of it (Klinger & Svensson, 2018: 4657).

X (Twitter) enables decentralised forms of communication and facilitates freedom of expression, as evidenced by its influence on political and social issues (Breindl, 2012). However, its actual impact has been the subject of debate, tempering expectations about the platform's revolutionary potential for grassroots movements. For example, Neumayer & Struthers (2018: 89) recognise that speed and virality might encourage activists to mobilise, but they also note that this carries a risk of making the movement appear to be based on immediate, knee-jerk reactions (i.e., retweets, shares and likes).

Different studies have focused on contemporary activism and on its mediatisation, a process that has been intensified by digitalisation and media hybridisation. Indeed, a close relationship exists between social media and activism, in such a way that the former shapes and determines the actions of the latter in the online sphere, through different types of communication practices.

Digitalisation influences the way contemporary activism takes shape, by facilitating the creation of communities around certain hashtags (Breindl, 2012). In fact, in the last few years, it has sought to go beyond the circulation and coverage of traditional news media, seeking out its own spaces in which communication becomes a dialogue between users; and in which certain narratives can be suggested via the creation of hashtags, and also where other kinds of resources can join in – such as the creation of controversies or the channelling of indignation as a method of protest. One of the most famous and most analysed cases is that of the feminist movement #MeToo, mentioned above.

Several studies have identified key functions of hashtag activism, noting that hashtags serve essential roles such as categorising content, facilitating its discovery, increasing the visibility of social causes, coordinating collective actions and democratising debate by amplifying the voices of marginalised groups (Onyari & Ekevere, 2025). Moreover, digital tools such as hashtags have been shown to foster the formation of collective identities and to mobilise individuals who are not traditionally engaged in activism (Sudirman et al., 2024). Nevertheless, scholars have also pointed out major limitations of hashtag activism, arguing that it can be episodic and overly dependent on

specific events, which raises challenges regarding the long-term sustainability of social movements (Zulli, 2020).

In this respect, modern communication theories have increasingly focused on emerging social phenomena driven by social media, introducing key concepts such as '*deep mediatisation*' (Couldry & Hepp, 2013). This approach describes a scenario in which the interconnections between traditional and digital media, the ongoing digitalisation of content and the creation of an open and interconnected communication space shape new dynamics of social interaction. This is not merely a shift in communication tools but a structural transformation in the ways information is produced, circulated and consumed within hyperconnected societies.

Deep mediatisation has redefined the logics of organisation, expression and collective mobilisation. Within this new digital ecosystem, virtual communities emerge around hashtags or labels, which not only make specific causes more visible but also foster decentralised networks of participation and action (Kaun & Uldam, 2017; Breindl, 2012; Wang, Liu & Gao, 2016). These communication practices enable more flexible, immediate and emotionally resonant forms of participation, thereby reshaping modes of public engagement and activism. In this context, debate generated on platforms such as X (Twitter) plays a central role in constructing collective meaning, directly influencing the representation of minorities and social movements, including those oriented towards environmentalism. This mediatisation not only amplifies their visibility but also affects how their actions are interpreted by the public.

Thus, the rise of digital media within today's hybrid communication system not only transforms the media landscape but also challenges traditional structures of power and symbolic authority, expanding the very boundaries of the concept of 'mediatisation' (Couldry & Hepp, 2013).

More specifically, a number of studies have examined climate activism in social media (O'Brien, Selboe & Hayward, 2018; Almeida, 2019; Von Zabern & Tulloch, 2021; Sorce & Dumitrica, 2021). These studies characterise online climate activism as a youth activism, interlinked with other causes; hence the connections with anti-capitalist, feminist, LGTBI+ and anti-racist movements, among others.

The studies identify the main ways these movements use social media (to provide information, mobilise supporters online and offline, offer opinions, apportion blame, etc.) and allow us to assess their relevance in the area of social struggle. To this effect, the recent study by Sorce & Dumitrica (2021) on Fridays for Future shows how this movement uses online communication not so much as a medium for struggle and activism but 'to communicate for offline participation'. As a result, we are unable to consider the social media used by Fridays for Future as relevant in the 'framing and circulation of its key message' (Sorce & Dumitrica, 2021: 263).

3. Method

This study aims to analyse the possible contribution made to the climate change struggle by the digital conversation around the actions of Just Stop Oil and Last Generation on the microblogging platform X (Twitter). This platform has proved its significance as a forum for social action based on spontaneous and instant discussion (Campos-Domínguez, 2017), along with its capacity to reach a wide audience (Murthy, 2012).

In line with the research questions posed in this study, we chose a qualitative methodological approach, applying social network analysis techniques to the paradigm of 'big data'. Social network analysis uses computational methods and different metrics to characterise the nodes and general structure of a network. These metrics include *modularity* and *centrality* (for identifying which nodes are the most important or central). Modularity is a measurement of the structure of networks or graphs, and measures the strength of division of a network in communities (Noack & Rotta, 2009). High modularity means that these networks have connections of greater intensity between nodes at the heart of the community itself, but weaker connections between network clusters. Centrality defines which nodes are the most important or central in a particular network. The centrality of a node is related to the '*in-degree*' (number of edges that point towards the given node) and the '*out-degree*' (number of edges pointing away from the given node). In this study specifically, the in-degree represents the attention received by a node or X-user (Twitter-user) via mentions received, including retweets, replies and direct mentions.

The sample for this research consisted of 275,248 tweets published between 1 and 31 October 2022, a time window designed to collect reactions to Just Stop Oil and Last Generation protest actions. The tweets examined were selected either because they included the hashtags *#lastgeneration*, *#letztegeneration* and *#juststopoil*, or because the text included the name of one or more of the groups 'last generation', 'letzte generation' and 'just stop oil'. These three hashtags were selected following exploratory analysis in which no other significant hashtags were observed relating to the activist actions described above.

Specifically, tweet-related data extraction was carried out using X (Twitter)'s academic API (Borra & Rieder, 2014) retroactively, and the software Twarc. These tweets were then processed using Gephi social network analysis software. Through Gephi, and with the help of the Louvain multilevel algorithm method of community detection (Blondel et al., 2008), based on modularity optimisation, a network of mentions was created in which each participant in the conversation is represented by a node, and each interaction (retweet, reply or mention) is represented via an edge or connection.

Exploratory and inductive analysis of this network was carried out, as is common in the field of social network analysis, and each of its main communities was described in relation to the following elements:

— Top five tweets: a ranking of the most shared content in each community.
— Leaders of each community: in terms of in-degree, i.e. of mentions received by other users, whether via direct mentions, replies or retweets.
— Number of actors: equivalent to the number of nodes contained in each community.
— Percentage of actors: calculated for each community with respect to the total number of actors.
— Percentage of news media or journalists present in each community.
— Centralisation of each community: calculated from the distribution of the mentions in each community. Those communities with a centralisation greater than 50% are considered to have 'high centralisation' (These are generally communities in which one or few actors receive mentions, i.e. a few are mentioned by many). On the other hand, the communities with a centralisation below 50% are considered to have 'low centralisation' (They are communities made up of diverse protagonists, and in which there is a tendency to interact with diverse actors, i.e. communities in which many are mentioned by many).

Each community was given a name depending on its characteristics and actors; and the numbers of each community were assigned by the algorithm at random and should not be interpreted as being in numerical order.

In the interaction network, 2,517 communities were identified, of which seven accumulated over 3% of the nodes. These communities were examined in depth in this study, as they represent 68.27% of single mentions, i.e. 62.74% of the nodes or single users. The metrics for these communities are shown in Table 1.

Table 1. Metrics of the main communities

Community	Actors (N)	Actors (%)	Centralisation	Media (%)
12. Media against protests	25,213	16.23%	16%	3.62%
1. Reporting on Just Stop Oil's actions	22,171	14.27%	58%	3.01%
18. Discrediting Just Stop Oil (1)	13,780	8.87%	86%	1.24%
7. Discrediting Just Stop Oil (2)	12,876	8.29%	92%	1.02%
3. Support for the action at Tufton Street	9,185	5.91%	33%	2.40%
26. Absolute rejection of Just Stop Oil	7,684	4.95%	33%	3.18%
4. Criminalisation of Letzte Generation	6,551	4.22%	13%	1.70%

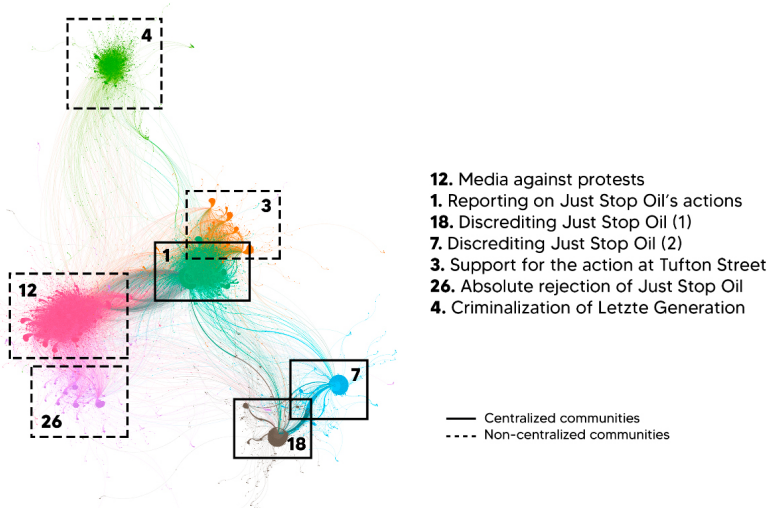
Source: authors' own creation.

4. Analysis

The conversation captured contained a total of 275,248 tweets by 227,505 single users. The interactions of this conversation are represented on a network graph in which 2,517 communities were identified via the Louvain mul-

tilevel algorithm (Blondel et al., 2008). Figure 1 shows a representation of the seven most significant communities. A summary of metrics from the different communities can be found in the Appendices (Supplementary Material).

Figure 1. Network graph and legend of the seven main communities



Source: authors' own creation using Gephi.

As an initial result, the graph denotes very isolated, not closely linked communities that are also very self-centred. More specifically, the seven most active communities – those containing over 3% of the nodes analysed and 62.74% of the total conversation (Table 1) – denote a conversation that is largely critical of the actions of Just Stop Oil and Last Generation. Discourse exchange is poor, with only two mutually permeable communities (18 and 7) and minor cohesion between others. What is notable is the fact that the communities that interact the most between one another do so only within their own discourses. In other words, the communities that are favourable – or neutral – towards the protest actions interact with one another, as do those communities that are critical of the protests. There is no interaction between clusters that support the actions and those that are against them. Lastly, there is also a peripheral community that posts content in German which is critical of the actions.

Community 12: Media against protests

Community 12 is the largest, with 25,213 actors or nodes, or 16.23% of the total. It is not a very centralised community (16%) and there is a shared prominence among different actors. The leaders of this community (leaders being those users that have received most mentions from the rest of the community) are freelance journalists and British independent or alternative news media,

although there are also some reactionary X (Twitter) members. The community has a distinct geographical feature, as it is based in the United Kingdom.

The predominant tone within this community is critical of the way the protests were carried out and the damage caused by the activists (even calling for them to be accused of the murder of a woman who was unable to get to hospital in time). Similarly, they criticise the excessive news media coverage and prominence given to the activists, along with their very raison d'être, and they describe them as 'privileged'. They also demand greater police action against the protests.

Community 1: Reporting on Just Stop Oil's actions

Community 1, the second largest with 22,171 nodes (14.27%), is centralised (58%) and led mainly by Just Stop Oil, with information about its actions. In fact, the top five tweets include three tweets by Just Stop Oil. The rest of the community mainly consists of freelance photographers and journalists who covered the protests favourably. Again, this community is largely based in the UK.

Community 18: Discrediting Just Stop Oil (1)

The third largest community consists of 13,800 actors (8.87% of the total) and focuses its discourse on discrediting the group Just Stop Oil due to its relationship with oil dynasty heiress Aileen Getty. Similarly, the community is critical of the group's supposed financing via cryptocurrency, financing which could be counterproductive in terms of their environmental demands. This community is led by anonymous users, some of whom are very active on social media, especially in relation to topical and controversial issues. In this case, there is a diverse geographical component, but it is centred on the USA. There is, likewise, a high level of centralisation within the community itself (86%) towards one specific tweet, in which The Climate Emergency Fund, founded by Aileen Getty, was revealed as the financial source of Just Stop Oil.

Community 7: Discrediting Just Stop Oil (2)

Community 7 has 12,876 actors or nodes, 8.29 % of the total. It is a highly centralised community (92%), in which the main conversation centres around one tweet, once again concerning Just Stop Oil's links to Aileen Getty, even suggesting that oil companies pay protest organisations. We can observe permeability between this community and community 18, with the two communities sharing the same discourses and even the same tweets in their top five. Among the leaders of this community, we find, once again, anonymous users, with a more diverse geographical component than community 18, but equally centred on the USA.

Community 3: Support for the action at Tufton Street

Community 3 is made up of 9,185 actors or nodes, or 5.91 % of the total. It is not very centralised (33%), its leaders being an amalgamation of British

politicians with ecological sympathies, along with independent news media entities. Their discourses are diverse, although the majority show agreement with the cause promoted by Just Stop Oil, specifically in agreement with the action of spraying orange paint on the building at 55 Tufton Street, an address linked to several influential right-wing organisations. This action is labelled as being more coherent, as it directly attacked those causing the problem instead of attacking paintings. Similarly, it can be seen that the leading tweets in this community have also had a wide repercussion (i.e. a large number of retweets) on a general level.

Community 26: Absolute rejection of Just Stop Oil
Community 26 has 7,684 actors or nodes, 4.95% of the total. It is not a very centralised community (33%). Its discourse is conservative and it consists of a diverse selection of actors, particularly writers and journalists based mainly in the USA. This community uses a tone that rejects the actions of Just Stop Oil in London, even demanding that it be designated a transnational eco-terrorist organisation. There is also a tone of ridicule towards the organisation, labelling them as 'weirdos' or 'freaks'. Once again, importance is given to the tweet regarding the woman who died as a result of being unable to reach hospital in time due to roadblocks set up by activists, together with indignation at the damage caused to paintings, which they label as 'destroyed'.

Community 4: Criminalisation of Last Generation
Community 26 consists of 6,551 actors or nodes, 4.22% of the total. This community is not very centralised (13%), with its geographical component being centred in Germany, the country of origin of the activist group Last Generation, which carries out similar protests to Just Stop Oil and is therefore suspected of having the same financial sources. In this case, the predominant tone of the conversation is one of disgust at the protest actions. We see assertions like 'these ecologists should get a proper job', or even calls for criminalisation, calling them 'delinquents' and demanding legal action against them from the police and the German government.

In line with the third research question that guided this study, we paid special attention to the role of the news media in this digital conversation. We observed that both the independent news media and freelance journalists have played a very discreet role in digital communities, in which their presence has never reached 4% (Table 1). In the largest community (12) the nodes with a higher number of mentions correspond precisely to independent journalists and news media, although these limit their discourse to spreading the tone of indignation at the consequences of the activists' protests. In other words, the news media's role has not been one of leadership – either in terms of presence or discourse –; instead they have reflected indignant tone expressed against the protests that dominated the digital conversation, while leaving aside the climate issue being protested about. Likewise, it is worth noting the absence of the legacy media in this conversation.

5. Conclusions and discussion

The graph (Figure 1) shows the presence of isolated user communities with little mutual interaction, an aspect that accounts for the limited exchange of opinions and viewpoints in the digital conversation. Thus, we could confirm the existence of a situation of discourse polarisation and a low level of dialogued conversation in relation to the examined actions of Just Stop Oil and Last Generation (RQ1), since there is no interaction between the favourable and unfavourable clusters or communities.

On the other hand, the high centralisation of some communities enables us to see that we are witnessing an activism with strong leaders and unique discourses. In this sense, it is significant that those communities which showed a favourable tone towards ecological protest actions are precisely those led by the group Just Stop Oil itself and by green politicians. In this case, hashtag activism did not have a component of protest, but rather served as a medium for spreading and publicising the actions carried out by ecological protest groups. This activism of strong leaders also reflects the absence of diverse social perspectives in the digital conversation, a fundamental aspect in the fight against climate change.

Similarly, the analysis of the tweets indicates a conversation with a predominantly critical tone towards these actions. This critical tone was shaped by visceral, indignant tweets, even with an element of hatred towards activist groups. These dynamics coincide with those described by recent academic literature in relation to the capacity of discussions on X (Twitter) to polarise individuals' perceptions of different issues (Foderaro & Gunnarsson, 2023). Specifically regarding climate change, some years ago the study by Anderson & Huntington (2017) also explained how, in the case of extreme meteorological events, resources such as sarcasm and incivility are used to polarise the debate, in some cases even leading to verbal attacks. Likewise, our study data aligns with other previous evidence, such as that presented by a survey carried out by the Annenberg Public Policy Center, which revealed that almost half of those surveyed (46%) considered that Just Stop Oil's tactics decreased their support for efforts to address climate change (Patterson & Mann, 2022).

In line with previous studies that highlight user polarisation as one of the main disadvantages of social media for communicating climate change (Cook, Ellerton & Kinkead, 2018), this study concludes that these kinds of controversial actions do not contribute to a significant or effective debate in terms of mobilisation; and so it is worth questioning what the reach or contribution of the digital conversation on X (Twitter) around the actions of Just Stop Oil and Last Generation can achieve in the fight against climate change (RQ2). It should also be emphasised here that this type of tactic is part of a new style of protest that is more symbolic and closely linked to visibility on social media; nevertheless, we have seen in this study that this impact has been somewhat limited in the cases examined. This type of media

visibility differs from that traditionally pursued by organisations against climate change such as Greenpeace, whose confrontational tactics sought to intervene between the environmental criminal and the victim, i.e. by directly questioning the causes of environmental risk.

Thus this study reveals the existence of a certain backlash towards the symbolic actions of these activist groups, in the form of indifference or rejection of the attacks on artworks. This invites us to reflect on the utility of this type of action in the medium and long term, in showing that the controversy these tactics generate is transformed in the digital conversation into 'noise' towards the concept and the relevance of the climate change struggle in general, rather than into raising awareness or a collective hashtag activism action capable of overcoming the limits of social media and having an impact offline. This noise contributes to disinformation in relation to actions against climate change, a common situation in environments such as X (Twitter), and adds to tendencies such as the polarisation noted above, as the study by Jang & Hart (2015) showed some years ago.

Within this context of increasing polarisation surrounding science (Rekker, 2021), the idea of 'climatic obstructionism' becomes significant, and is linked to the ecological protest actions or tactics that have been examined in this study. In this respect, it could be argued that these controversial actions, and the conversation they generate, involuntarily promote a certain 'climate obstructionism' in the form of inaction and denial. Climate obstructionism has become an umbrella term for terms such as denialism, delayism and inaction, which are insufficient by themselves to describe the complex reality that hinders the taking of action against climate change (Ekberg et al., 2023).

The idea of climate obstructionism reminds us that, faced with scientifically contrasting realities, objectivity requires an attitude of campaign, education and enabling; albeit that the analysis of user communities demonstrates that the legacy media does not play a notable or active role in this sense, and limits itself to reproducing information about these actions in order to achieve a higher dissemination for news already published in its online and offline editions (RQ3).

Based on these findings, it is appropriate to advance towards a more reflective consideration of how communication and political practices shape contemporary forms of digital climate activism. In this regard, symbolic protest may benefit from greater integration between the emotional-visual impact of activist actions and communication strategies that foster community-building, the development of shared interpretive contexts, and sustained narrative coherence over time. Likewise, the limited presence of legacy media and the marginal role of independent outlets within the communities analysed may signal underlying tensions between the expressive codes of contemporary activism and the normative routines of journalistic institutions. This disconnect between media ecosystems and collective action appears to contribute to a depoliticization of climate discourse, whereby media coverage tends to emphasise episodic or sensational elements while overlooking broad-

er structural aspects. Finally, a promising line of research emerges around the affective, emotional and performative aspects of these communication dynamics. Reactions such as indignation, irony or theatricalisation not only enhance message circulation but also shape the meanings attributed to activist interventions. A more nuanced understanding of these dimensions could support the development of communication strategies that move beyond reactive and fragmented logics, offering more effective responses to the dynamics associated with climate obstructionism.

Beyond the temporal and contextual nature of the dataset, as already acknowledged, several methodological constraints should be noted, as they qualify the scope of the findings. First, the use of social network analysis tools, while effective for mapping large-scale interactions, is inherently shaped by its reliance on quantifiable variables and by algorithmic biases that influence content visibility and circulation (Kitchin, 2017). Although the analysis of large volumes of posts provides access to discourses circulating within the digital public sphere (Freelon, Mcilwain & Clark, 2016), it should not be interpreted as a direct measure of public opinion or attitudes (Lin et al., 2013). This also means that the possible presence of bots, astroturfing campaigns and the uneven representativeness of X (Twitter) data across different demographic groups needs to be considered.

To summarise, despite its methodological limitations and its exploratory nature within a highly specific context, this study helps reveal some of the less favourable aspects of the digital environment in terms of communication practices based on scientifically validated information, such as those surrounding climate change. Thus social media may therefore be unreliable when user conversations and circulating messages devolve into fragmented noise, but without a coherent form of digital activism, it becomes more difficult for the message, the debate and consequently the climate cause itself to gain traction in public discourse or to exert influence on institutions.

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