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RESEARCH ARTICLE

The "Green Pass" Controversy in the Italian Twittersphere: a Digital Methods Mapping

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ABSTRACT: In this paper we developed a digital methods mapping of the controversy arises from the adoption of the so-called "Green Pass" in Italy Adopting an "agnostic" approach to our object of study, we used a well-established research design: namely, to collect all the tweets that contain words related to conversations about the green pass in Italy (e.g.: green pass, #greenpass). In this way, the sample collected amounts to 4.307.487 tweets, published between June 15, 2021, and December 15, 2021. To bring out the "voices" of the different actors involved in the controversy we adopted a quali-quantitative approach: on the one hand, by means of computational techniques, we reconstructed the structural relations in which the actors are involved and its evolution over time; on the other hand, by means of content analysis we enriched our map with an interpretation of the discourse surrounding the controversy. Finally, these cartographic results are discussed considering the Italian media system functioning, in order to understand how its conformation may have influenced the public debate concerning the green pass.

KEYWORDS:

Public Debate; Controversy Mapping; Digital Methods; Covid-19; Green Pass.

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1. Introduction

The rapid and in some ways unexpected Covid-19 pandemic caught most countries around the world unprepared, prompting several governments to adopt as precautionary and exceptional measures a set of restrictions designed to contain the risks of citizens at a time of extreme uncertainty related to the absence of knowledge about the virus. As pointed out from the very beginning of the pandemic by several STS scholars, policy decisions such as the one related to the closure of activities and personal restrictions are intrinsically linked to the role that science has assumed in our societies (Anderson 2021). On the one hand, experts assist the technical choices made by governments and policymakers, while on the other hand, the same choices made by governments are evaluated by scientifically grounded explanations (Weingart 1999). In both cases, the scientific knowledge accumulated at a given time thus plays a crucial role in both guiding strategies and justifying or disproving the decisions made (Saltelli et al. 2020; Brusselaers et al. 2022). Consequently, the Covid-19 outbreak offered a unique opportunity to momentarily place at the center of the public debate not only the issues surrounding the virus discoveries, but also the very process of scientific knowledge development, dissemination, and governance.

It is indeed arguable that one of the unintended effects of the choices made to embank contagions and deaths during the Covid-19 epidemic was to make salient the science-and-society's nexus potentially for everyone. However, a grounded discussion on the role of science in society on such a large scale has proven to be very difficult, and there are several upstream motives that we can identify. A first reason is surely the rapidity with which the global pandemic crisis unfolded, which caught much of the scientific world itself unprepared at a time when all social actors (from institutions to policy makers or simple citizens) were looking for clear information with which to act (Gallotti et al. 2020); the second concerns the emergence of differing scientific viewpoints, which, however, at a time of great stress and needed uncertainty's reduction, prompted individuals to maintain a strong positioning with respect to the proposal closest to their own experience as to diminish cognitive dissonances (Sacco et al. 2021); finally, the most important point in our opinion concerns the very structure in which these discussions' processes were embedded, namely that of a public space that increasingly links the media system and the scientific field (Pilati and Anselmi 2022; Miconi and Risi 2022).

Starting from the above assumptions, in this paper we developed a mapping of a peculiar socio-technical controversy: namely, the adoption of the so-called "Green Pass" in Italy during the Covid-19 epidemic (in simplistic words, a pass that certifies the absence of Covid-19 infection via a test or via the fact that a person is vaccinated). The controversy surrounding the green pass is indeed an exemplar case of how the adoption of new scientific norms in social life is a process "*in fieri"* that results from a negotiation between the technical object itself, the field's experts, and the broadly conceived public sphere (i.e., politicians, media and citizens). In Italy the controversy over Green Pass takes on a particular significance as it has been used as a radical nudging measure to incentivize the vaccinations (Moccia et al. 2022), but also to exclude a part of the population from work, schools, public venues and public transportation. As a result of this, a thorough political examination and a serious public debate would be expected to take place. From this point of view, an increasing amount of literature has shown how people express their personal viewpoints, including their feelings and opinion about social facts, in an increasingly common way through social media and that Twitter can be considered as a reliable tool to monitor public opinion dynamics (Boccia Artieri et al. 2021). Therefore, the purpose of this paper is twofold. First, using Twitter as our digital field, we mapped the evolution of the controversy overtime, and we described the roles and positions of involved actors. Secondly, the same

cartographic results are discussed considering the Italian media system functioning, in order to understand how its conformation may have influenced the debate and the broader controversy concerning the green pass.

2. Why and how to map controversies with digital methods

Since the 2000s and even more so during the Covid-19 pandemic, several scholars have pointed out an increasing proliferation of issues related to science and technology in public debates, particularly referring to issues linked to the role and use of expert and scientific knowledge in society (Venturini and Munk 2021). For these authors, this change is mainly due to two different and parallel developments taking place in our societies: on the one hand, as mentioned earlier, the role of technoscience is increasingly central to a myriad of daily activities and public choices, thus also becoming a recurring theme for news and debates (Marres 2005); on the other hand, the emergence of the web 2.0 and the expansion of social networking sites has in fact changed the old logic of operation of the media systems themselves by making hegemonic a business model based on the digital attention economy (Goldhaber 1997; Venturini 2019).

In this context, in which different actors are constantly and incessantly searching for issues that can attract public attention, the so-called socio-technical controversies can promote high-activation feelings, such as outrage and rivalry, which are very effective in capturing attention. Therefore, in the so-called hybrid media ecosystem controversies tend to be pushed at the center of public debates (Venturini and Munk 2021). Nevertheless, the regulatory mechanisms based on the attention economy at the same time obstacles the controversies' societal-changing capability. Indeed, one of the lateral consequences of the digital economy is to accelerate both the news cycle and the related attention devoted to the topics covered by journalism (Castaldo et al. 2022). This accelerated formation of a debate can pushes audiences towards confirmatory bias and, as consequence, creates the basis for the polarization of public opinion (Cinelli et al. 2021). Therefore, even if controversies spread broader and faster than before, it seems more and more difficult to effectively address the same controversies in a democratic sense and find a way for their resolution.

To address whether a controversy unfolds and how it ends, the most consolidated approach is certainly the one coming from actor-network theory (Latour 1987). Controversy mapping is a methodology developed by Bruno Latour in the 90's to help students of MINES's school in engineering engage with the different ways in which society enters scientific processes (Latour 2007; Venturini 2010). Soon after its invention, due to the birth of web 2.0 studies, controversy mapping resurfaced thanks to the development of open-source tools pertaining to digital methods (Venturini 2012). Consequently, in the last ten years an explosion of empirical research that used digital media to trace controversy took place (Venturini and Munk 2021). Indeed, using a digital methods approach could be useful in many different ways (Venturini and Latour 2010): first, thanks to the temporality of digital traces it's possible to follow the evolution of a controversy over time (Venturini et al. 2014); second, relying on the concept of actor-network (Venturini et al. 2019) it is feasible to depict the broader context in which the interaction between single actors and media ecosystems take place; finally, thanks to the affordances of specific platforms (as Wikipedia or Twitter), a relevant part of the bottom-up and public dimension of a controversy can be taken into account (Venturini et al. 2015).

3. Research Design

In the vein of Actor-Network Theory (ANT), we choose a quanti-quali research design to empirically map the Twitter discussion related to the green pass controversy in Italy (Munk 2019). Starting from the encounter between ANT tradition and the discovery of digital methods, controversy mapping has in fact made use of the digital traces and computational tools at its disposal in an innovative way: distancing itself from a prescriptive model in the use of data science techniques, controversy mapping seeks to use big data to recreate the complexity of interactional micro-processes among the involved actors, while at the same time it relies on the richness of ethnographic material left behind to interpret emerging phenomena (Venturini and Latour 2010).

Adopting an agnostic approach to our object of study, in this paper we used an established data collection in controversy mapping via digital methods (Marres and Weltevrede 2013; Marres and Moats 2015; Marres 2015): namely, to collect all the tweets that contain words or hashtags related to conversations about the adoption of the "green pass" policy in Italy (i.e., green pass, #greenpass) and use Italian as their primary language. This way, the dataset collected through the official Twitter V2 search API amounts to 4.307.487 tweets, published between June 15, 2021, and December 15, 2021.

The choice of Twitter as the data resource for our mapping stems from three different motivations. The first reason is preemptively methodological and concerns the possibility of finding all the content circulated on the platform related to the topic of our interest. The second, on the other hand, concerns the desire to capture both top-down and bottom-up discussion, thus consequently we need to rely on social media in which interactions are based on public logic. Finally, we decided to capture tweets as opposed to Facebook posts because Twitter had grown considerably during the initial phase of the pandemic (e.g., +34% in 2020, see Rojas 2020), mainly due to the influx of new users seeking an online arena where to discuss Covid-related topics (see Kwak et al. 2010 for an insightful description of Twitter as a 'news driven' social media).

Mapping part1: macro-structure

Initially to get a first glimpse on the general trends that the controversy has taken in Twitter, we focused on its temporal evolution. To do this, we counted and plotted the number of tweets issued daily: in this way, on the one hand it was possible to observe the general pace of the debate (e.g., did the debate develop consistently over-time or did it advance by means of extemporal peaks?) while on the other hand it was possible to understand its interaction with the advancement of the green pass legislation (e.g., did the introduction of new rules trigger the debate or not?).

The second step in our research was related to a wide reconnaissance of the debate structure, to do this we decided to rely on two different strategies. A first metric concerns the average daily percentage of retweets and replies out of the total number of tweets: in this way we had a rough measure on how much the conversation was based on the general production of original content or was instead driven by a few tweets. Secondly, we calculated the Gini coefficient on the concentration of retweets in order to understand the verticality or horizontality of the debate with respect to prominent influencers (Bracciale, Martella and Visentin 2018). Indeed, in our case the Gini coefficient measures the extent to which the distribution of retweets within our dataset deviates from a perfectly equal distribution. A coefficient of 0 expresses perfect equality where everyone has the same retweets, while a coefficient of 1 expresses full inequality where only one person has all the retweets.

Mapping part2: meso-structure

Starting from the insights gained through the time series analysis we then moved our focus to a more detailed cartography of the controversy. In order to map the communities of actors and users involved we have employed a pure retweet network (i.e., excluding mentions and comments): this entails an assumption, namely it presumes that retweeting something means, most of the times, an endorsement of the original tweet; while some Twitter users routinely state that 'RT is not endorsement' we do have substantial empirical evidence of the contrary, at least when it comes to extrapolate wider user communities (Metaxas et al. 2015).

Since a mapping of meaningful interactions requires narrow time windows (Venturini et al. 2019), we decided to consider three moments of greatest activity in the Twitter debate. The first corresponds to the days following the official introduction by law of the green pass for closed spaces regulation (i.e., July 22 and 23 equivalent to ~150k tweets), the second moment is the one straddling the decree introducing the green pass obligation also for private and public workers (i.e., October 14 and 15 equivalent to ~160k tweets), and the last one refers to the twitter discussion following the introduction of the so-called super-green pass obtainable only through vaccination (which occurred on the 24 and 25 of November and amounted to ~110k tweets). This selection of cases thus allowed us both to have three photographs of different crucial moments in the evolution of the controversy, and at the same time to follow in a balanced way its development over the six-month period we considered.

For each of the selected time periods we extrapolated from our datasets all the retweets and we built three different directed networks. In these retweets' network, each node represents a user while an arc between two nodes, whose value is unitary, indicates a retweet of a specific tweet made by the user to whom the arc is directed. To identify the communities within the retweet networks we used the community detection algorithm called 'Louvain' (Blondel et al. 2008). This algorithm optimizes the modularity function, which measures the density of internal arcs of a single community compared to that of external arcs. To measure the permeability between each cluster of users identified, we relied instead on a similar parameter called 'E-I Index' (Krackhardt and Stern 1988). While in fact through the study of modularity it is possible to have a general measure of how fragmented a network is, when applied to the same modules identified by the Louvain's algorithm the E-I index allows to measure the openness or closure of each most prominent cluster. Indeed, the E-I parameter measures the portion of internal arcs, i.e., directed from one member to another of the same community, compared to the number of external arcs, i.e., directed from a member of a community to an external member. Using this measure, a node whose arcs connect only to nodes outside the community will have an E-I equal to +1 while, for a node whose arcs connect only to nodes inside the community, the E-I will be equal to -1. Since these extreme values are very rare in a real-world context, within the spectrum of values between -1 and +1, the E-I becomes a reliable measure of a node's tendency to connect to nodes within its community. From these measures, it is possible to convert the total number of internal and external arcs into a normalized index which, defined in this way, can represent a good estimate of how closed the communities are, i.e., how their structure is similar to an echo-chamber.

Mapping part3: micro-structure

The operations described so far allowed us to map the macro and meso-structures of the interactions among the actors and users involved in the controversy on Twitter, but at the same time they still cannot describe in

detail the opinions and positions of the very same. To make up for this lack, the last two choices made in our research design are focused on visual network analysis and qualitative content analysis. Let us anticipate that both choices are consequential again from the previous research outcomes: indeed, as we will illustrate in more detail in the results section, the green pass debate developed in an extremely hierarchical way, with only a few and very influential accounts that centralize the information flow and consequently also few tweets able to dictate the overall agenda.

Firstly, to have a more ethnographic kind of information related to the actors' positioning, we decided to filter our retweets networks by keeping only the most influential accounts. To visualize the reduced retweet networks, we used the open-source software Gephi (Bastian et al. 2009). The images shown below were obtained by applying firstly the visualization algorithm 'Force Atlas 2' at the entire retweet network (Jacomy et al. 2014) and then by removing the nodes whose sum of outgoing arc weights is less than 20 (that is Gephi's automatic calculated and suggested threshold to maximize the reading of our network maps without losing relevant nodes spatialization). By means of these reduced samples, and by keeping node labels only for public Twitter accounts, we were therefore able to navigate and describe in detail the role and relation of politicians, journalists, health experts and legacy media during the controversy.

Finally, to gain a deeper insight into the viral contents that drove the debate, we extrapolated and closed-read the 50 most retweeted tweets for each time windows considered. Indeed, the retweeting of these top-50 tweets hegemonize respectively ~35%, ~30% and ~45% of total content production for July, October and November peaks, thus making it possible to avoid sophisticated computation techniques in place of a traditional qualitative analysis.

4. Results

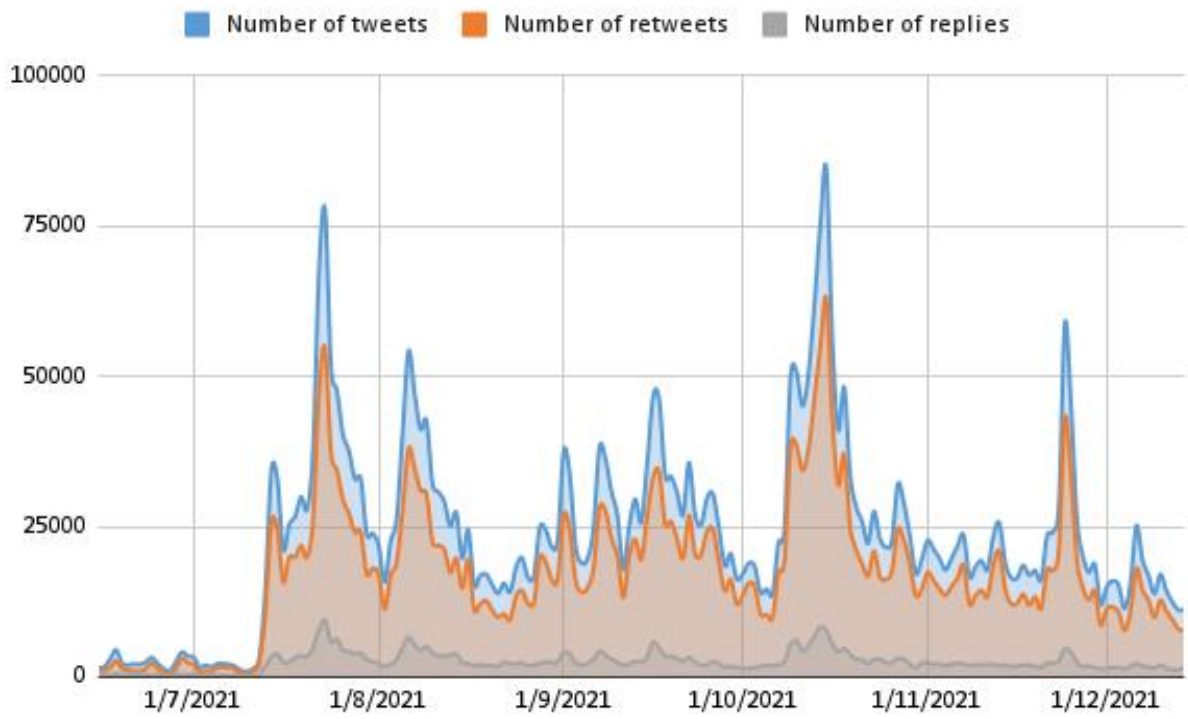
4.1 Attention Spikes and Information Centralization

The stickiness and consistency of an issue is an indicator of whether or not the discussion of the topic itself is driven by prolonged or ephemeral cycles of attention (Boydstun et al. 2014a) and can be therefore conceived as a proxy for the emergence of a stable public arena (Hilgartner and Bosk 1988). Though originally conceived for a mass media environment (Downs 1972), these concepts can also find application in today's digital context, if properly repurposed for analyzing social media's debates.

In the case of the Green Pass debate on Twitter, we can see how after an initial period of low interest from July 13, 2021 (date of the *"Pass Sanitaire"* introduction in France), the awareness of this issue grew immediately. Indeed, the average number of daily tweets from this point in time onward is 27k tweets per day, with a minimum value of ~11k tweets and a maximum value of ~85k tweets. The fluctuating trend can be intercepted visually in Figure 1. By looking at the development over time of the debate regarding the green pass controversy, we can thus describe two different dynamics. The first concerns the advancement by initially increasing and then decreasing spikes, thus showing how the green pass discussion has grown very rapidly and then wanes over time (particularly after the mandatory introduction of the pass at work). Another result concerns instead the causes of peaks' triggering: these latter in fact are springing at the same time of legislative moments, thus suggesting that the debate rather than following a grassroots logic is conversely a reaction to the agenda setting of the political and media system in which it is embedded. A second observation that is immediately apparent from the figure is the disproportion of the number of retweets to the total number of

tweets produced during the period we considered. In fact, as many as 75% of the total content consists of retweets while another 10% consists of replies. This means that the number of original contents in the discussion is only 15% out of the total number of tweets produced.

Chart 1 - Tweets, retweets and replies per day



The very same disproportion is also evident by looking at the top-50 most retweeted contents per day, that on average hegemonize as much as 35% of the daily total content production. Taking a close look at the underlying interactional dynamics of this result, we can see how there is also a huge inequality in the source of the original tweets. In fact, the Gini index calculated on retweets is equal to 0.79, showing a large inequality in the centralization of debate with respect to few and very influential users. The huge amount of non-original content and the resulting centralization of information, while not new in the Twitter debate related to Covid-19 (Sacco et al. 2021), is thus a sign of a strong hierarchy of sources and of a top-down communication flow related to the green pass controversy.

4.2 The emergence of closed and polarized communities

Collective phenomena are made of opposition as much as of alliances and in Actor-Network theory perhaps social relations are defined by their "enemies" as much as by their "friends" (Latour 2007). The affinity between ANT and SNA has therefore been successfully used to exploit network analysis for controversy mapping as it produced particularly interesting results when applied to digital traces (Venturini 2010; Venturini 2012). In our specific case mapping the emergence of communities and their openness or closure in Twitter is

thus an important first step in understanding the positions of actors within the green pass controversy, therefore here we will resume the highlights from the quantitative network analysis carried out.

The first retweets network we considered is that of July. This network is composed of 28.570 nodes. The Louvain community finding algorithm identified more than 500 communities. However, amongst these, the first five clusters gather as much as 90% of all nodes. Of these five leading communities only one presents a positive E-I index, while the other four have strongly negative results in the External-Internal links ratio (see table 1).

Table 1 - 22-23 July retweets network statistics

Communities (Louvain)	*Nodes (%)*	*E-I index (-1/+1)*
Cluster 1	~30	-0.39
Cluster 2	~20	-0.35
Cluster 3	~20	-0.57
Cluster 4	~10	-0.68
Cluster 5	~10	+0.41

The second retweets network we took into account is that of October. This network is composed of 24.650 nodes. The Louvain algorithm identified approximately 120 communities. Amongst these, the first five clusters are equal to around 90% of all nodes. Also in this case, of the leading communities only one presents a positive E-I index, while the other four have strongly negative scores (see table 2).

Table 2 - 14-15 October retweets network statistics

Communities (Louvain)	*Nodes (%)*	*E-I index (-1/+1)*
Cluster 1	~35	-0.65
Cluster 2	~25	-0.42
Cluster 3	~10	-0.24
Cluster 4	~10	-0.41
Cluster 5	~10	+0.33

The third retweets network we considered is the November one. This network is composed of 14.578 nodes. The community finding algorithm identified approximately 350 communities. Amongst these, the first seven clusters gather approximately 90% of all nodes. Of all the main communities only one presents a positive E-I index, while the other six have strongly negative scores (see table 3).

Table 3 - 24-25 November retweets network statistics

Communities (Louvain)	*Nodes (%)*	*E-I index (-1/+1)*
Cluster 1	~30	-0.63
Cluster 2	~15	-0.22
Cluster 3	~10	-0.67
Cluster 4	~10	-0.43
Cluster 5	~10	-0.37
Cluster 6	~10	-0.59
Cluster 7	~5	+0.21

Pulling together all the statistics, the most important result for our controversy mapping purpose pertains to the emergence of stable-in-time, close-influenced and polarized communities. Combining the E-I index finding with the Gini index result we can in fact realize how the former is due to a partisan selection of sources, based on super-influencers who are closest to one' s own positioning regarding the green pass controversy. Nevertheless, at each of the three time points considered it is possible to see a remaining cluster always having a positive E-I index, which is why it is possible to identify these kinds of clusters as bridges between the otherwise hyper-polarized communities.

4.3 From ideological reframing to a yes/no-pass "flame war"

Although there are several techniques for network visualization, one family of algorithms has gradually established itself as the standard for visualizing graphs: the so-called "force-directed" spatialization or "force vectors" (Venturini, Munk and Jacomy 2019).

A force vector layout works according to a physical analogy: nodes receive a repulsive force that pulls them apart, while edges act as springs that bind the nodes they connect. Once launched, the algorithm changes the layout of the nodes until an equilibrium is reached. This balance minimizes the number of line crossings and thus maximizes the readability of the graph. Not only do force vectors minimize line crossings, but they also make sense of the arrangement of nodes in space. In a network spatialized by forces spatial distance acquires meaning: two nodes are closer the more directly or indirectly connected they are (Jacomy et al. 2014). This way, spatialization can effectively re-materialize notions of graph mathematics. It was shown that visual clustering in networks spatialized by forces is directly equivalent to clustering with modularity algorithms (Noack 2009). Centrality, betweenness, diameter, density, structural separation, all these concepts (and many others) recover their graphical meaning (Venturini, Jacomy and Jansen 2021). They cannot only be calculated, but also seen. This is where the figurative power of networks takes place: it is here that the deepest link between SNA and ANT can be found.

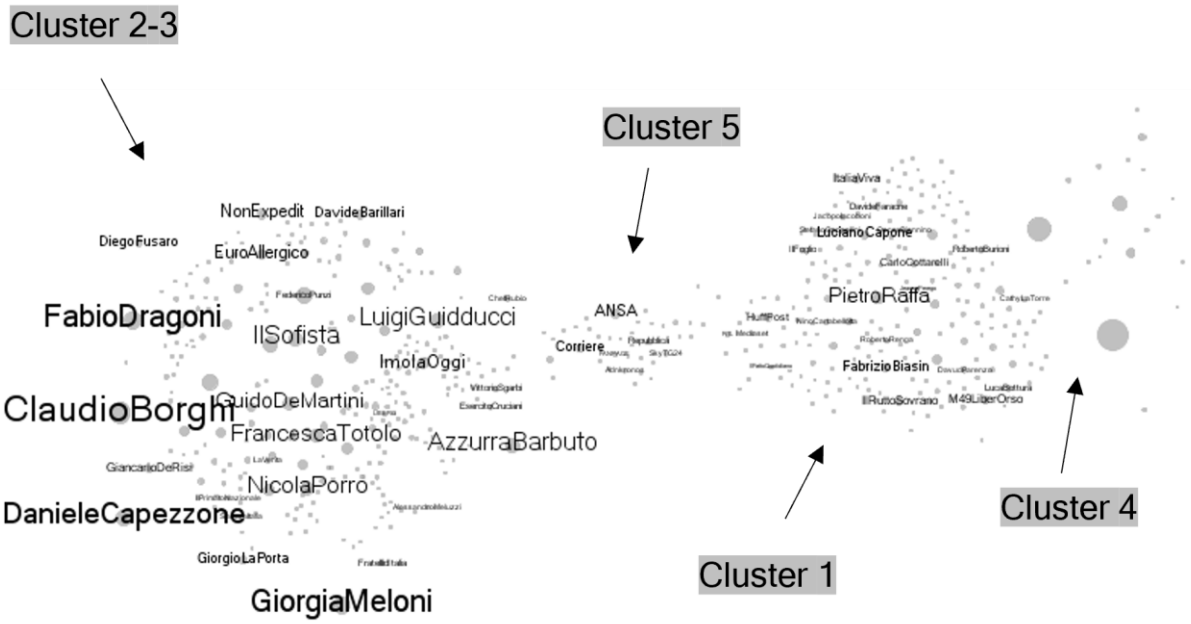
Therefore, for our purposes, the results that we previously showed served in essence to prepare the field for a more minute and qualitative mapping. This latter is thus composed of two parts: as suggested by Venturini and colleagues (2019) we will illustrate the interactional positioning among actors precisely using the visualization of retweet networks, while contemporarily we will explore what typology of content triggered the debate.

22-23 July: the "green pass" is made mandatory in public spaces

By looking at the forced-directed network visualization in Figure 1, it is possible to notice how, during the first peak of July, the discussion on Twitter started immediately under a strong division, thus being cut into two clearly distinguishable macro-areas. The first one is located on the left of the network visualization and is formed by cluster 2 and 3. This community is composed of both newspapers, journalists and politicians belonging to the Italian right-wing parties and nationalist movements. The second area, on the right, is instead composed of members belonging to clusters 1 and 4. Of these members, the most retweeted are satire web pages accounts and users made up of both physicians and scientists as well as journalists and pundits referring to center-left political parties. Finally, at the center we find an area composed of legacy media that works as a bridge. It is to remember that cluster 5 is also the only one with a positive value assumed by the E-I index,

remarking the fact that the discussion generated through mainstream media accounts and then took the roots of polarization following mainly ideological and political drivers.

Figure 1 - 22-23 July retweets network visualization



Source: *The images reported were obtained using the 'Force Atlas 2' visualization algorithm in Gephi (Bastian et al. 2009; Jacomy et al. 2014). This visualization algorithm builds visual clusters from the proximity between two nodes in the graph, considering this proximity as both a direct and indirect (i.e., mediated by a third node) exchange of information. Applying such a tool to visualize digital networks (as in our case for Twitter) is therefore particularly useful to explore communities that are homogeneous in practices or opinions (Venturini et al. 2021). Finally, the size of nodes and labels are proportional to the number of retweets received.*

Digging deeper into the texts of the tweets, the discourses that can be traced through the content analysis of the most shared tweets in the different clusters confirm a polarization not only at network level but also regarding narratives.

Within the clusters on the left of the network, it is possible to trace two different discursive matrices. The first and most evident is what we could define as a skeptical narrative related to the vaccine efficacy and to the very existence of the virus. This narrative is also defined by an open accusation against the "powers that be" (as the Italian government, Europe or drug firms) who, aware of the inutility and of the damage, still want people to be vaccinated anyway.

"Fino a ieri: zero contagi in Gran Bretagna, Merito dei vaccini!!! oggi: record di contagi un Gran Bretagna, Ci vuole il Greenpass!! Ma la piantiamo??? Intanto in Svezia dove non hanno mai fatto nè lockdown, nè isterie, nè mascherine i contagi sono a zero e i morti pure." (1259 retweets)

"A FRONTE DI RISCHIO ZERO COVID PER I GIOVANI LE REAZIONI AVVERSE COLPISCONO SOPRATTUTTO LORO Per quale motivo dobbiamo metterli a rischio? GIù le mani dai ragazzi!!! In Germania le vaccinazioni ai giovani sono sconsigliate (e niente greenpass). Facciamo come loro" (775 retweets)

A second narrative within this area on the left of the network is carried out by right-wing politicians and is based on an invective against the government and the leftists, guilty of trying to take control over the individual freedom of Italian citizens.

"L'idea di utilizzare il green pass per poter partecipare alla vita sociale è raggelante, è l'ultimo passo verso la realizzazione di una società orwelliana. Una follia anticostituzionale che Fratelli d'Italia respinge con forza. Per noi la libertà individuale è sacra e inviolabile" (1531 retweets)

"Eravate quelli ai quali pesava il culo tirare fuori il passaporto per andare in Francia; eravate quelli dei porti aperti per un mondo senza frontiere. Oggi siete quelli che invocano il #greenpass pure per comprare il pane. Siete e sarete sempre FECCIA." (572 retweets)

Regarding the clusters 1 and 4 on the right of the network the narratives are more jagged, but at the same time found as common denominator the use of irony or caustic tones. On the one hand some users rely on tweets that point out how the green pass is comparable to precedent vaccine obligation or with other typologies of regulated social norms. On the other hand, collectivists' style of arguments is carried out in a more critical way by also directly attacking the "no-pass" area's exponents.

Sapete perché il GreenPass andava fatto? Perché sono le 9 e siamo già alla terza persona novax convinta che chiama per spostare l'appuntamento perché oggi deve andare al centro vaccinale a vedere come fare per essere rimesso in lista. Perché non erano idealisti, solo egoisti." (1774 retweets)

Mi scrivono che la posizione giusta per un liberale sarebbe: libertà dal vaccino, no green pass, no chiusure e no obblighi in generale. C'è un po' di confusione tra essere liberale e essere cretino" (1062 retweets)

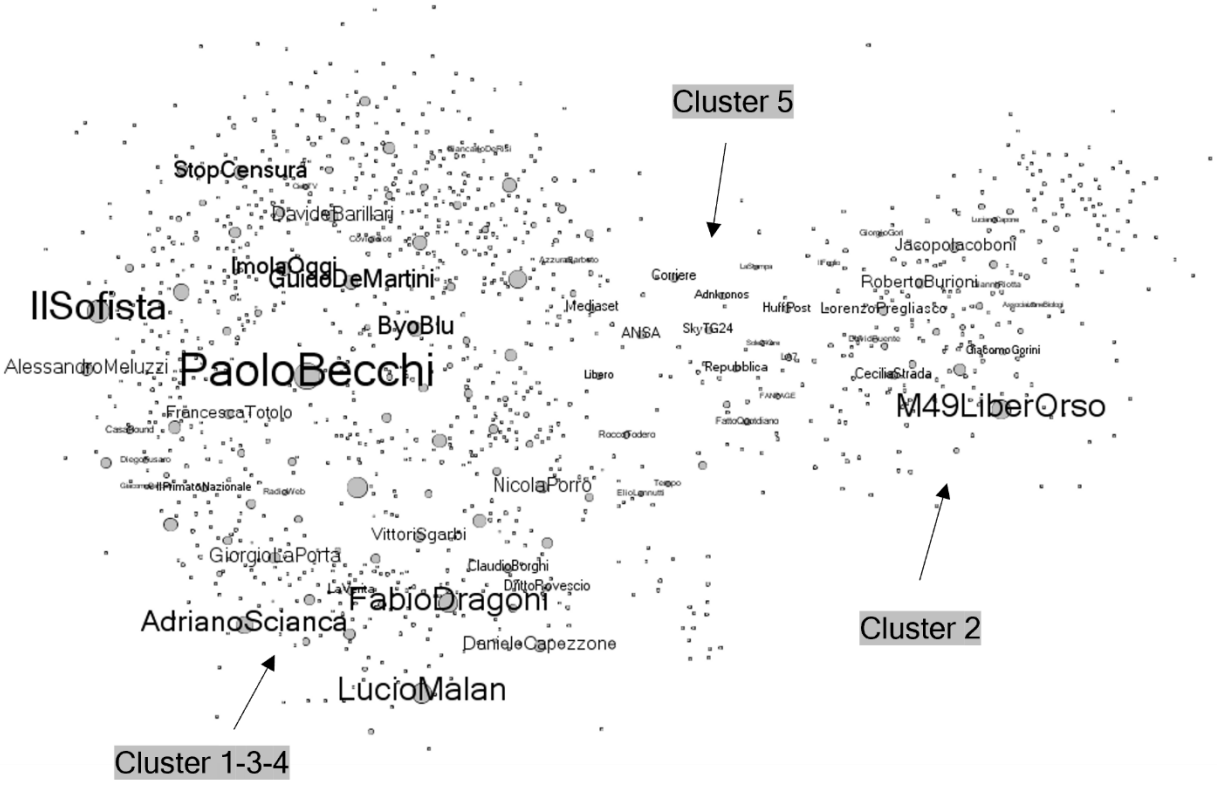
Putting the dots together, the analysis of this first Twitter spike highlights how during the introduction by law of the green pass the Twittersphere instantly split into opposite factions. This immediate polarization is made even more evident by the discourses present in the different clusters: the rhetoric used is in fact simple and is based on ideological divisions that were already evident in the general debate on the Covid-19 and preceded the Green Pass controversy (see for example Caliandro et al. 2020 and Pilati and Anselmi 2022). As we have seen, there is a strong rift both at the level of opinion leaders driving the communities and at the level of internal narratives. Following that, the most retweeted content itself exhibits characteristics that are often offensive to the opposing faction and invoke frictions between political sides. Therefore, the debate on the role of science in society seems to be widely underrepresented and relegated only to its declination into ideological and moral formats rather than reflexive and analytical ones.

14-15 October: "green pass" starts to be mandatory also at workplaces

The discussion peak of October presents characteristics that are very similar to the July one (such as the bridging role of legacy media or the yes-no pass clusters alignment), but it accentuates several features. Above all, ongoing radicalization is evident. This is due to a strong self-selection of opinion leaders taking part in the controversy and by accepting or not accepting the green pass as a zero-sum game between the two factions. Indeed, if in July the cleavage was mainly played out on established political lines (libertarians/collectivists; right/left) this differentiation in October is no longer present or at least is very weakened. For on the one hand, in the no-pass area on the left side of the network visualized in Figure 2, the actors involved are mainly

influencers and opinion makers linked to tabloid journalism who spectacularize issues related to the green pass. On the other hand, in the yes-pass area on the right of the network, the remaining relevant actors are composed of physicians and satirical web pages that, in different ways, present their cause as a mission of debunking the "fake news" and unscientific information that in their opinion drives the no-pass area.

Figure 2 - 14-15 October retweets network visualization



The content analysis of the most shared tweets also confirms a radicalization of clusters positions, to the expense of a possible common ground for discussing the motivations and limitations of having adopted a divisive and controversial measure as the green pass. Within the "no-pass" clusters 1, 3 and 4 the narrative regarding the constitutionality of the green pass or its actual effectiveness seems to fade. Its substitution instead gave way to a stream of outbursts and to strikes coverage.

"Se ci fosse stato Salvini premier e avesse messo lui il green pass per il lavoro secondo voi la #CGIL avrebbe applaudito o sarebbe in piazza a gridare contro l'attacco fascista ai diritti dei lavoratori?" (1266 retweets)

"#greenpass Di foto come queste non troverete notizia. E cioè di liberi cittadini, che con fascismo violenze non hanno nulla a che fare, andati a Roma per manifestare il proprio dissenso sull'obbligo del "Green Pass" ma sono stati brutalmente manganellati dalla Polizia di Stato." (1144 retweets)

"Lo sciopero dei #portualidiTrieste dichiarato illegittimo dal regime. I #portuali fermeranno il porto lo stesso. Poi #Draghi spiegherà alla Germania perché le sue scorte son bloccate a causa di un #greenpass sul lavoro esistente solo in Italia. Ti piace fare il duro? Anche a noi." (1179 retweets)

At the same time also the yes-pass area points towards the street demonstrations. Indeed, on the one hand some users underlie the discrepancy between "real-life" issues and the "nonsense" problematization around the green pass, while on the other hand a blaming argument against the no-pass demonstrators is reiterated.

"Questi sono i delinquenti nel momento in cui assaltano la sede della #Cgil. Chi ha dato copertura ideologica, filosofica, morale e politica a questa follia no green pass in buona fede, sappia che dopo oggi la presunzione di buona fede non vale più." (1671 retweets)

"Morti sul lavoro TUTTI ZITTI Licenziamenti TUTTI ZITTI Evasione fiscale TUTTI ZITTI Femminicidi TUTTI ZITTI Green Pass RIVOLUZIONE" (1201 retweets)

"E se scendessero in piazza i 43 milioni e mezzo di italiani che si sono vaccinati per la libertà di tutti? #greenpass #portualiditrieste #vaccinoobbligatorio" (771 retweets)

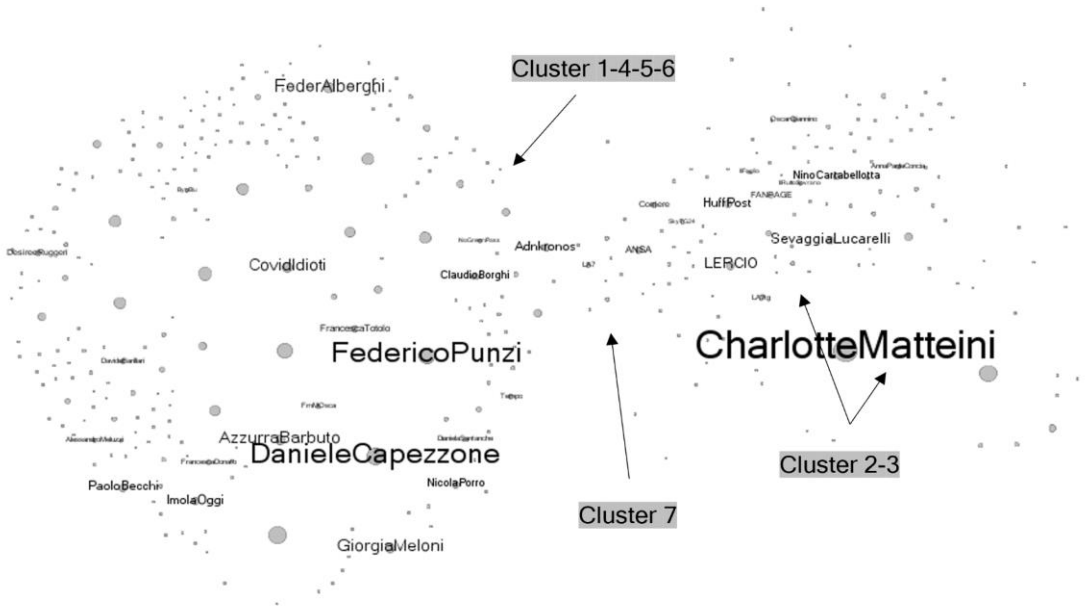
Considering the radicalization of opinion influencers embroiled in the debate and the parallel entrenchment in oppositional confrontation rather than dialogue, also in the October surge it is thus clear how the green pass controversy is struggling to develop. In fact, if already in July a reasoned and reflexive questioning seemed decidedly minoritarian, with the introduction of the green pass obligation for the workplace the debate shifts even more to the clashing locus of "knowledge/ignorance," thus seriously undermining the demands of those who would like instead to talk about the government's choices as a negotiation of the role of scientific-driven policies itself. This situation seems inevitably to lead to a simplistic reduction of the issue by describing the green pass as a scientific "right or wrong" application rather than a tool for regulation and power within society.

24-25 November: "green pass" is obtainable only via vaccination

The last attention spike we considered is the November one, triggered by the introduction of vaccination only pass to access certain places.

The ongoing division between the no-pass and yes-pass front is clearly visible; nevertheless, Figure 3 shows also how the role of the media system (understood as news outlets, journalists, pundits, and experts) has definitely declined, giving way to several small clusters led mostly by internal Twitter leaders who have consolidated on the Covid-19 front: in proportion to the nodes the labels have decreased, a sign that there are fewer public figures in the debate while at the same time "ordinary" users increased.

Figure 3 - 24-25 November retweets network visualization



Looking more in detail at the most retweeted content of the conversation, what emerges from the network analysis is confirmed. First, we can see how the moral divide between those who are for and those who are against the pass continues unchanged through pre-positioning-like arguments.

"Morti ogni biennio per infezioni ospedaliere: 100.000. Per tumore: 360.000. Per problemi cardiaci: 460.000. Per #Covid: 3.783 (dati #ISS di oggi). I colpevoli di falsificazioni, arresti illegali, violenze e discriminazioni vaccinali #greenpass, siano condotti ai processi. #3783" (982 retweets)

"In Austria un 55enne è morto di covid dopo aver partecipato ad un coronaparty organizzato per infettarsi ed ottenere il green pass senza doversi vaccinare. Darwin Award assegnato per acclamazione." (879 retweets)

"Per me potete introdurre anche il Green Pass super saiyan di quinto livello basta che all'ingresso lo chiediate o che mettiate multe da paura per chi non lo richiede porco di un porco giuda" (837 retweets)

On the other hand, compared to previous peaks where media pressure was evident, however, dialogue and critical questioning from ordinary users seems to come out. This category is divided mainly on two fronts: on the one hand the very scientific reason for the measure is questioned, while on the other hand content related to the green pass legal controversy manages to emerge more consistently.

"Il metodo comunque è sempre quello: C'è un problema? Si offre soluzione sbagliata, il problema si aggrava, si propone più soluzione sbagliata. C'è il debito pubblico? Austerità! Non funziona? Ci vuole più austerità! C'è il covid? Green pass! Non funziona? Ci vuole più green pass!" (827 retweets)

"SPAGNA COVID-FREE? NO il covid circola ma il governo spagnolo ha deciso di convivere con il virus senza vessare i cittadini con imposizioni e limitazioni inutili e DANNOSE come il #greenpass ritenuto incostituzionale. In Spagna niente odio tra cittadini, né segregazione. SI VIVE" (560 retweets)

"L'emendamento al DL 127/21 è in contrasto con il Regolamento UE sul #GreenPass, che prevede la non conservazione dei dati, e non è compatibile con la risoluzione 2361 del @coe su possibili discriminazioni per la scelta vaccinale, e con la normativa giuslavoristica #GarantePrivacy" (1116 retweets)

"SI APPRENDE: un gruppo di parlamentari ha presentato due ricorsi - uno alla Corte Costituzionale e uno agli organi giurisdizionali della Camera - contro il #greenPass a Montecitorio." (471 retweets)

The November results thus suggest on the one hand that the primarily oppositional and polarized dynamic of debate continues to prevail on Twitter, but at the same time a new trend concerns tweets directly related to the technoscientific controversy. Despite this opening towards a more focused discussion about the green pass policy as such, however, this change seems too little and too late to change the fortunes of a controversy that never really unfold in the Twitter debate, and instead, as we had seen, could have exacerbated even more the societal laceration linked to Covid-19 issues.

5. Discussion

Wrapping up the overall results of our research, the analysis carried out only partially overlaps with the findings of existing studies. What seems to be confirmed, is the succession of peaks in online public debate, which has been already referred to as "Twitter storm" (Boydstun et al. 2014b). The alternance between high- and low-intensity periods has been detected in the Twitter discussion about Covid-19 as well (Leng et al. 2021), with synoptic analyses of dozens of countries – 87, to be precise – revealing the same pattern (Islam et al. 2020). Another feature typical of hybrid media system that is confirmed by our analysis is the relevance of disintermediation in the polarization processes. Indeed, in the clusters of polarized communities there's a preponderant presence of satirical pages (e.g., Lercio), blogs (e.g., Il Sofista) and pages of non-traditional newspapers that are somewhat emblematic of disintermediate journalism that takes place on social media (e.g., Imola Oggi, ByoBlu, StopCensura). Polarization also seems to be linked to the role played by the accounts of politicians (and not, for example, by those of the parties) and of para-journalists that are difficult to identify with a single media outlet and more easily identifiable as social media influencers and opinion leaders. Finally, also the accounts of scientists who became famous during the pandemic are prominent in the polarized clusters, thus reinforcing the idea that the phenomena of social media's disintermediation and personalization played a central role in both political and scientific online communication.

On the other hand, the role played by traditional gatekeepers in shaping online discussion is a result which will require deeper attention. Legacy media regularly take the center of the diagram in all three cases, therefore providing a bridge between otherwise separated clusters of users. To some extent, though, the technical function of these bridges is not totally aligned with their social function, as mainstream journalists also appear to be frequent igniters of polarization tendencies. With this respect, traditional outlets incorporate the peaks which are typical of social media debate, with this tendency arguably having its roots in the highly polarized nature of the Italian media system (Hallin and Mancini 2004, p. 98-109). Our findings are somehow in line with partial assessment of the US debate, where both newspapers and Tv news have been producing polarization consequences and framing effects (Sol Hahn, Chinn and Soroka 2020) – to the point that the compliance with Covid-related restrictions was higher in the areas with strong Tv watching, rather than in those more violently affected by the epidemic itself (Kim, Shepherd and Clinton 2020). In the Italian case, we detected a sort of top-down polarization, with influential people – journalists, opinion-makers, or politicians – being responsible for the three storms in Twitter debate. In all cases, regardless of the decreasing magnitude of the peaks, the (alleged) digital public sphere splits into opposite fields, either totally accepting or totally refusing the Green Pass. The limited sharing of information and views among the different clusters is a main facet of the problem, as it is likely – as for example confirmed by an experiment realized in the US with a

sample of 3,200 citizens – that providing people with better information is key to "de-polarize the policy discourse at least around an easily identified set of issues" (Guidi, Romano and Sotis 2021).

As to the above-mentioned polarization of public debate, it has come with a serious blaming of political oppositions of any kind, put in place by many media outlets (Miconi and Risi 2022). The association of "no Green Pass" people with no-Vax, Covid-19 deniers and conspiracy believers can well be defined as a form of scapegoating, similar to that detected by Matthew Flinders in the English case (Flinders 2020; 2021). Even though "most individuals opposing the green pass share anti-vaccine views", the main argument behind the protests – as it emerged from an analysis of Telegram conversations – has rather to do with the political and legal definition of individual freedom (Spitale, Biller Andorno and Germani 2022). In this respect, the opposition to the green pass is probably resulting from the long-term legacy of critical positions, rather than from the understanding of the pandemic as such: as a matter of fact, the online discussion about "vaccine passports" has started at the beginning of 2021, well before its actual release (Crupi et al. 2022). According to some surveys, for instance, the percentage of citizens in favor of mandatory Covid-19 vaccination is significantly higher (45.5%) than the percentage of those "favorable to the adoption of the green pass" (33.3%) (Gallé et al. 2021, p.6). It is no surprise, therefore, that the debate around the green pass has taken the polarization tendencies to the next level, though the support or opposition to the measure does not properly overlap with classical political positions, in terms of voting preferences (Russo and Valbruzzi 2022, p. 177-178).

References

Anderson, W. (2021), "The model crisis, or how to have critical promiscuity in the time of Covid-19", *Social Studies of Science*, 51(2), 167-188.

Bastian, M., Heymann, S. and Jacomy, M. (2009), "Gephi: an open source software for exploring and manipulating networks", *Proceedings of the international AAAI conference on web and social media*. 3(1), 361-362.

Blondel, V. D., Guillaume, J. L., Lambiotte, R. and Lefebvre, E. (2008), "Fast unfolding of communities in large networks", *Journal of statistical mechanics: theory and experiment*, 2008(10), P10008.

Boccia Artieri, G., Greco, F. and La Rocca, G. (2021), "Lockdown and Breakdown in Italians' Reactions on Twitter during the First Phase of Covid-19", *Partecipazione e conflitto*, 14(1), 261-282.

Boydstun, A. E., Bevan, S. and Thomas III, H. F. (2014a), "The importance of attention diversity and how to measure it", *Policy Studies Journal*, 42(2), 173-196.

Boydstun, A. E., Hardy, A. and Walgrave, S. (2014b), "Two faces of media attention: Media storm versus non-storm coverage", *Political Communication*, 31(4), 509-531.

Bracciale, R., Martella, A. and Visentin, C. (2018), "From super-participants to super-echoed: participation in the 2018 italian electoral Twittersphere", *Partecipazione e conflitto*, 11(2), 361-393.

Brusselaers, N. et al. (2022), "Evaluation of science advice during the COVID-19 pandemic in Sweden", *Humanities and Social Sciences Communications*, 9(1), 1-17.

Caliandro, A., Anselmi, G. and Sturiale, V. (2020), "Fake news, Covid-19 e Infodemia: un esempio di ricerca sociale in real-time su Twitter", *Mediascapes journal*, (15), 174-188.

Castaldo, M., Venturini, T., Frasca, P. and Gargiulo, F. (2022), "Junk news bubbles modelling the rise and fall of attention in online arenas", *New Media & Society*, 24(9), 2027-2045.

Cinelli, M. et al. (2021), "The echo chamber effect on social media", *Proceedings of the National Academy of Sciences*, 118(9).

Crupi, G. et al. (2022), "Echoes through Time: Evolution of the Italian COVID-19 Vaccination Debate", *Proceedings of the International AAAI Conference on Web and Social Media* (Vol. 16, pp. 102-113).

Downs, A. (1972), "Up and down with ecology: The issue-attention cycle", *The public*, 28, 38-50.
Flinders, M. (2020), "Gotcha! Coronavirus, Crisis and the Politics of Blame Game", *Political Insight*, 11(2), 22-25.
Flinders, M. (2021), "Democracy and the Politics of Coronavirus: Trust, Blame and Understanding", *Parliamentary Affairs*, 74(2), 483-502.
Gallè, F. et al. (2021), "Acceptance of COVID-19 Vaccination in the Elderly: A Cross-Sectional Study in Southern Italy", *Vaccine*, 9, 12-22.
Gallotti, R. et al. (2020), "Assessing the risks of 'infodemics' in response to COVID-19 epidemics", *Nature Human Behaviour*, 4(12), 1285-1293.
Goldhaber, M. H. (1997), "The attention economy and the net", *First Monday*, 2(4). doi: 10.5210/fm.v2i4.519.
Guidi, S., Romano, A. and Sotis, C. (2021), "Depolarizing the Covid-19 Vaccine Passport", *Yale Law Journal*, 3850152.
Hallin, D. and Mancini, P. (2004), *Comparing Media Systems. Three Models of Media and Politics*. Cambridge: Cambridge University Press.
Hilgartner, S. and Bosk, C. L. (1988), "The rise and fall of social problems: A public arenas model", *American Journal of Sociology*, 94(1), 53-78.
Islam, M.S. et al. (2020), "COVID-19-Related Infodemic and Its Impact on Public Health: A Global Social Media Analysis", *The American Journal of Tropical Medicine and Hygiene*, 103(4), 1621-1629.
Jacomy, M., Venturini, T., Heymann, S. and Bastian, M. (2014), "ForceAtlas2, a continuous graph layout algorithm for handy network visualization designed for the Gephi software", *PloS one*, 9(6), e98679.
Kim, E., Shepherd, M. and Clinton, J.D. (2020), "The effect of big-city news on rural America during the COVID-19 pandemic", *PNAS*, 117(36), 22009-22014.
Krackhardt, D. and Stern, R. N. (1988), "Informal networks and organizational crises: An experimental simulation", *Social psychology quarterly*, 123-140.
Kwak, H., Lee, C., Park, H., & Moon, S. (2010), "What is Twitter, a social network or a news media?", *Proceedings of the 19th international conference on the World wide web* (pp. 591-600).
Latour, B. (1987), *Science in action: How to follow scientists and engineers through society*. Cambridge: Harvard university press.
Latour, B. (2007), *Reassembling the social: An introduction to actor-network-theory*. Oxford: Oxford University Press.
Leng, Y. et al. (2021), "Misinformation During the COVID-19 Outbreak in China: Cultural, Social and Political Entanglements", *IEEE Transactions on Big Data*, 7(1), 69-80.
Marres, N. S. (2005), *No issue, no public: Democratic deficits after the displacement of politics*, Amsterdam: Ipskamp Printpartners.
Marres, N. and Weltevrede, E. (2013), "Scraping the social? Issues in live social research", *Journal of cultural economy*, 6(3), 313-335.
Marres, N. (2015), "Why map issues? On controversy analysis as a digital method", *Science, Technology, & Human Values*, 40(5), 655-686.
Marres, N. and Moats, D. (2015), "Mapping controversies with social media: The case for symmetry", *Social Media+ Society*, 1(2).
Metaxas, P., Mustafaraj, E., Wong, K., Zeng, L., O'Keefe, M., & Finn, S. (2015), "What do retweets indicate? Results from user survey and meta-review of research", *Proceedings of the international AAAI conference on web and social media* (Vol. 9, No. 1, pp. 658-661).
Miconi, A. and Risi, E. (2022), "Framing pandemic news. Una ricerca sulla rappresentazione del Covid-19 nei news media italiani", *Problemi dell'informazione*, 47(1), 31-61.
Moccia, G. et al. (2022), "Vaccine Hesitancy and the Green Digital Pass: A Study on Adherence to the Italian COVID-19 Vaccination Campaign", *International Journal of Environmental Research and Public Health*, 19(5), 2970.

Munk, A. K. (2019), "Four styles of quali-quantitative analysis: Making sense of the new Nordic food movement on the web", *Nordicom Review*, 40(s1), 159-176.
Noack, A. (2009), "Modularity clustering is a force-directed layout", *Physical Review E*, 79 (2).
Pilati, F. and Anselmi, G. (2022), "The AstraZeneca affair. A digital methods mapping of the Covid-19 vaccination controversy in the Italian hybrid media system", *Tecnoscienza*, 2/22.
Rojas, J. (2020) Coronavirus: Lockdowns drive record growth in Twitter usage, Sky News, 23 July 2020.
Russo, L. and Valbruzzi, M. (2022), "The impact of the pandemic on the Italian party system. The Draghi government and the "new" polarization", *Contemporary Italian Politics*, 14(2), 172-190.
Sacco, P. L., Gallotti, R., Pilati, F., & De Domenico, M. (2021), "Emergence of knowledge communities and information centralization during the COVID-19 pandemic", *Social Science & Medicine*, 285, 114215.
Saltelli, A. et al. (2020), "Five ways to ensure that models serve society: a manifesto", *Nature*, 582.
Sol Hahn, P., Chinn, S. and Soroka, S. (2020), "Politicization and Polarization in COVID-19 News Coverage", *Science Communication*, 42 (5), 679-697.
Spitale, G., Biller-Andorno, N. and Germani, F. (2022), "Concerns Around Opposition to the Green Pass in Italy: Social Listening Analysis by using a Mixed Methods Approach", *Journal of Medical Internet Research*, 24(2):e34385.
Venturini, T. (2010), "Diving in magma: how to explore controversies with actor-network theory", *Public understanding of science*, 19(3), 258-273.
Venturini, T. and Latour, B. (2010), "The Social Fabric: Digital Footprints and Quali-Quantitative Methods", *Proceedings of futur en Seine*, 87-101.
Venturini, T. (2012), "Building on faults: how to represent controversies with digital methods", *Public understanding of science*, 21(7), 796-812.
Venturini, T. et al. (2014), "Three maps and three misunderstandings: A digital mapping of climate diplomacy", *Big Data & Society*, 1(2)
Venturini, T. et al. (2015), "Designing controversies and their publics", *Design Issues*, 31(3), 74-87.
Venturini, T. (2019), "From fake to junk news: The data politics of online virality", in D. Bigo, E. Isin, E. Ruppert (eds.), *Data Politics*, London: Routledge, pp. 123-144.
Venturini, T., Munk, A. K. and Jacomy, M. (2019), "Actor-Network versus Network Analysis versus Digital Networks: Are We Talking about the Same Networks?", in J. Vertesi and D. Ribes (eds.), *digitalSTS*, Princeton, Princeton University Press, pp. 510-524.
Venturini, T., Jacomy, M. and Jensen, P. (2021), "What do we see when we look at networks: Visual network analysis, relational ambiguity, and force-directed layouts", *Big Data & Society*, 8(1), 20539517211018488.
Venturini, T. and Munk, A. K. (2021), *Controversy Mapping: A Field Guide*. London: Polity Books.
Weingart, P. (1999), "Scientific expertise and political accountability: paradoxes of science in politics", *Science and public policy*, 26(3), 151-161.

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