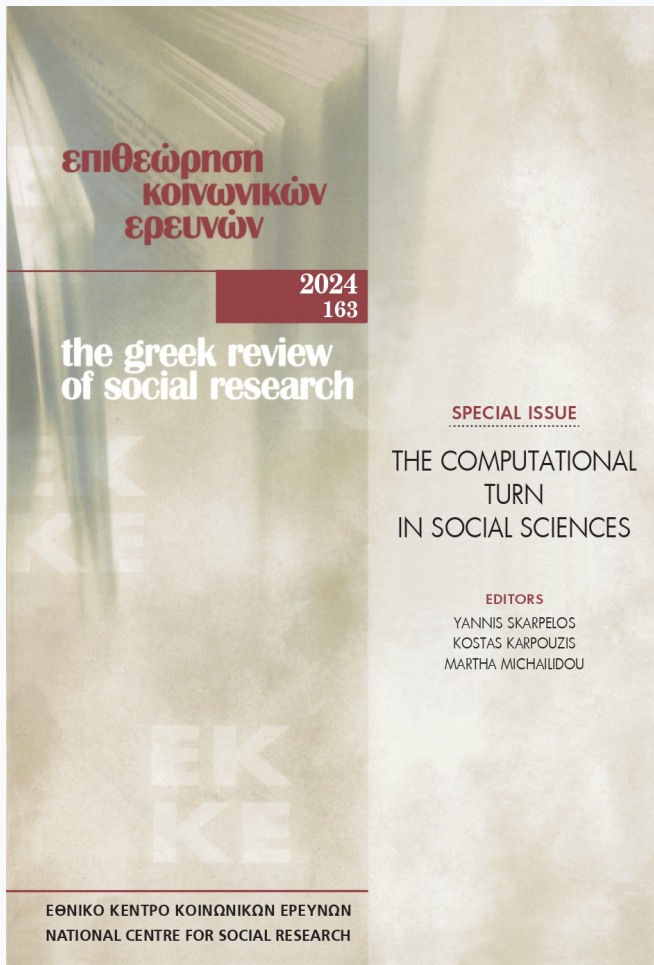


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A cure worse than the disease? The controversy on Twitter around a fake COVID-19 treatment from France

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A CURE WORSE THAN THE DISEASE?
THE CONTROVERSY ON TWITTER AROUND
A FAKE COVID-19 TREATMENT FROM FRANCE

ABSTRACT

This paper analyzes both the network of actors and the network of the discourses mobilized in the controversy around Professor Didier Raoult and his Hydroxychloroquine-based therapeutic proposal against COVID-19. To confirm our hypothesis, we implement a sophisticated and innovative research method on a corpus of 1.2 million Tweets, which consists of applying a network analysis combined with a lexicometrics analysis. We show that the reaction peaks on Twitter were linked to important media events. Moreover, many groups clustered around the accounts of political figures and media outlets that received numerous mentions. Trump's and Bolsonaro's supporter groups also connected with the French-speaking pro-Raoult groups. The messages of the pro-Raoult combined anti-science conspiracy theories and a critique of the political economy of liberalism and its impasses.

Keywords: *controversy, Covid-19, Twitter, discourse, network analysis, Iramuteq*

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ΜΙΑ ΘΕΡΑΠΕΙΑ ΧΕΙΡΟΤΕΡΗ ΑΠΟ
ΤΗΝ ΑΣΘΕΝΕΙΑ; Η ΔΙΑΜΑΧΗ ΣΤΟ TWITTER
ΓΥΡΩ ΑΠΟ ΜΙΑ ΨΕΥΔΟΘΕΡΑΠΕΙΑ
ΤΗΣ COVID-19 ΑΠΟ ΤΗ ΓΑΛΛΙΑ

ΠΕΡΙΛΗΨΗ

Το άρθρο αυτό αναλύει τις αλληλεπιδράσεις των χρηστών και τις διαφοροετικές ρητορικές που αναπτύχθηκαν στο Twitter σχετικά με τη θεραπεία με υδροξυχλωροκίνη που πρότεινε ο Γάλλος καθηγητής Didier Raoult κατά της Covid-19. Η μελέτη συνδυάζει την ανάλυση δικτύου με μια λεξικομετρική ανάλυση σε ένα σύνολο 1,2 εκατομμυρίων tweets. Μεταξύ των ευρημάτων μας, συμπεραίνουμε ότι διαδικτυακές ομάδες φιλικά προσκείμενες προς τον Donald Trump και τον Jair Bolsonaro συνδέθηκαν με γαλλόφωνες ομάδες υπέρ του Raoult. Μεταξύ των υποστηρικτών του Raoult κάποιοι προπαγάνδισαν αντιεπιστημονικές θεωρίες συνωμοσίας ενώ άλλοι άσκησαν κριτική στην πολιτική οικονομία του φιλελευθερισμού. Τέλος, βρήκαμε επίσης ότι οι κορυφώσεις των αντιδράσεων στο Twitter συνδέθηκαν άμεσα με την κάλυψη της πολεμικής από τα κυρίαρχα ΜΜΕ, πχ. μέσω συνεντεύξεων του Raoult.

Λέξεις κλειδιά: διαμάχη, Covid-19, Twitter, ανάλυση λόγου, ανάλυση δικτύου, Iramuteq

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INTRODUCTION

The climate crisis has moved complex scientific problems to the heart of the political arena and has, similarly, multiplied scientific controversies in the public sphere (Brossard, 2009). The media, especially digital media, play a central role as arenas of confrontation, where relevant actors develop “arguments and contradictory points of view that lead them to propose different versions of the social and the natural world” (Callon, 1986, p. 175).¹ A prominent example of such a controversy is the issue of global warming, which has been the subject of intense public debate for years – and is still being challenged today (Hulme, 2009). As Bruno Latour notes, nowadays, the complexity of public problems is coupled with the complexity of the media system itself, resulting in the public being confused about fundamental issues and how to get informed about them: “lost in the problem, the public is now also lost in the media addressing the problem” (2010, p. 229).

The Covid-19 pandemic, particularly its early phase, enabled the proliferation of many controversies wherein opposing arguments clashed, challenging the establishment of a scientific consensus on many topics, such as the origin of the virus, the way to deal with the pandemic, or effective treatment methods. Recently, theories about a potential lab leak as the origin of the virus gained traction when FBI Director Christopher Wray said in an interview with Fox News that it “most likely” originated in a “Chinese government-controlled lab” (Khatsenkova, 2023). However, this was later challenged by another investigation led by the US Department of Energy, which characterized this theory as “low-confidence,” meaning that there is not sufficient data to draw safe conclusions (Khatsenkova, 2023).

These controversies are characterized by disputes, attempts at misinformation, and rumours of all kinds, demonstrating the difficulty of having a debate based on a rational exchange of arguments, especially due to the lack of reliable information (Brennen et al., 2020). A case in point was the proposal to prescribe HCQ² against Covid-19, which was mainly advanced by 70-year-old French microbiology professor Didier Raoult, a specialist in infectious diseases at the University Hospital Institute of Marseille (IHU). His proposal, in conjunction with his personality, gave

1. All translations of quotes from French to English are from authors.

2. For ease of reading, we will use the acronym HCQ to designate the two substances that have been the subject of scientific controversy, i.e., chloroquine and hydroxychloroquine, which is recognized as less poisonous.

way to countless exchanges of arguments around the subject by a multitude of actors (medical doctors, scientists, politicians, journalists, and public figures but also ordinary citizens).

THE CASE OF DIDIER RAOULT

Well before the pandemic, Raoult had appeared several times in the national media. Yet, his dramatic appearance in the affairs of the pandemic was made through several videos published on the YouTube account of the IHU, which he managed. The first video, in which Raoult plays down the risk of Covid-19, was published on 21 January and received more than 450,000 views. However, the publication of a very short video on 25 February, entitled “Coronavirus: towards a way out of the crisis?” with 750,000 views, was what made his popularity explode. In the video, Raoult delivers ‘a scoop’: Chinese researchers have tested the HCQ *in vitro* against the virus with positive results. Several other videos followed, five of which generated between one and two million views.

On 16 March 2020, one day before France went into lockdown, Raoult broadcasted a video, in which he announced to his students the results of the study conducted by his team to treat Covid-19 patients with a combination of HCQ-azithromycin. This video, viewed 1.5 million times on YouTube, triggered enormous media coverage, as measured by the National Audiovisual Institute (INA), and made Raoult’s character famous.³ The success of his personal Twitter account attests to this sudden popularity: created on 25 March 2020, it attracted 250,000 followers in just one week (962,000 by March 2023). Similarly, the open Facebook group “Didier Raoult Vs Coronavirus,” created on 20 March, was very successful and, according to the INA’s study, generated more shares than the pages of France’s leading newspapers, radio, and TV outlets, combined during the week of 23 to 29 March.

This media success led to numerous statements of support for HCQ and its promoter. Donald Trump declared, at the official press briefing on 19 March 2020, that HCQ “shows very encouraging preliminary results” and could be a “game changer” concerning the pandemic. Emmanuel Macron visited Raoult at the IHU on 9 April 2020, offering him further legitimacy and media credibility. However, gradually, after a series of scientific

3. <https://larevuedesmedias.ina.fr/etude-coronavirus-covid19-traitement-mediatique-raoult-chloroquine>

studies, an international consensus was reached at the end of the summer of 2020, indisputably affirming that the effects of HCQ in the treatment of Covid-19 are unfounded, at least regarding the mortality rate.⁴

THEORETICAL BACKGROUND AND HYPOTHESES

In this article, we seek to trace and analyze the networks of actors and their discourses surrounding this controversy on Twitter. We aim to contribute to a critique of the political economy of the digital public sphere to identify and dissect some of the mechanisms that are at the origin of the formation of the agenda and the framing of political facts in the public arenas of the internet, including those of scientific nature (Smyrnaioi, 2020). Our focus on the digital component of the public sphere does not mean that the latter is limited to the internet. On the contrary, the contemporary public sphere, both fragmented and global (Fraser, 2014; Habermas, 2022), is composed of a multitude of intertwined and connected spaces, where traditional media (press, audiovisual, etc.) and physical spaces of political deliberation (institutions, meetings, assemblies, demonstrations, etc.) still play a major role.

Nevertheless, for several years, online communication devices (digital media and social networks, various online forums) have been central to public debates (Tufekci, 2017). Twitter, in particular, constitutes a central arena where the prioritization of political affairs is largely played out (Weller et al., 2014). This is due to its open technical architecture, which makes it a popular communication and research platform, as well as due to its socio-political characteristics, like the over-representation of highly educated and highly politicized people, who are more likely to participate in complex controversies as the one discussed here (Boyardjian, 2016). We have to underline that this situation is gradually changing under the new owner of Twitter, Elon Musk, who converted the company into a privately traded entity, proceeded with massive layoffs, affecting many of the platform's functions like content moderation, while hindering researchers' access to data (Scott, 2023).

Our article attempts to test three central hypotheses. The first hypothesis posits that debates taking place on Twitter are in constant interaction with the so-called legacy media. We thus postulate that, as others have also noted (Ratinaud et al., 2019; Rieder & Smyrnaioi, 2012; Smyrnaioi &

4. <https://www.futura-sciences.com/sante/actualites/coronavirus-covid-19-morts-si-prescription-hydroxychloroquine-avait-ete-generalisee-80151/>

Ratinaud, 2017; Souillard et al., 2020), tweets about Raoult closely follow the media's agenda (notably his appearances on TV shows) and political affairs by involving a large number of the accounts of professional journalists, media, and politicians. We also believe that the involvement of foreign media and political actors in this controversy is due to the subject's transnational nature.

Our second hypothesis asserts that contemporary scientific controversies are part of the broader framework of questioning what Pierre Charbonnier has called "the modern forms of epistemo-political authority" (2020, p. 366). In other words, it is not simply a question of the rise of scepticism towards technoscience, which sometimes slides into conspiracy theories, but of a profound contestation of political and expert authority which is typical of the current crisis of liberal democracies under capitalism (Newman, 2023).

Finally, our last hypothesis, which follows the previous one, postulates that, far from the typical ideal of a "marketplace of ideas," where a democratic consensus can be formed through the confrontation of rational arguments, the digital sphere is a terrain of agonistic struggle (Mouffe, 2002) where multiple actors contend one another to impose their interpretation of the world. Thus, a battle for cultural and political hegemony is played out online between contradictory and often incompatible points of view, which deploys every resource (symbolic and material) and rhetorical tactic available. There is, therefore, no rationale for deliberation at work, which impedes the process of reaching a consensus. To test the validity of our hypotheses, we adopted a sophisticated and innovative theoretical and methodological approach that will be explained below.

THEORETICAL AND METHODOLOGICAL FRAMEWORK

In this study, we consider online political controversies as *web spheres* (Schneider and Foot, 2006). This concept is both a theoretical tool and a methodological proposal. A web sphere is defined as a set of freely accessible digital resources, spread over different web pages or internet services connected by links, which refer to a specific event or theme. It is thus a *public micro-sphere*, circumscribed both by a thematic orientation and by temporal limits. This thematic focus can be rather diverse (e.g., a news item, a social or political issue, a scientific or religious controversy, etc.), but it always implies a public problem, that one calls for government regulation or intervention.

A web sphere is limited in time, but its life span is not known in advance. It depends on the *ad hoc* commitment of the participants, which in turn is mutable and can be influenced by a multitude of factors (e.g., an unforeseen event can revive a controversy that seemed to have died out). The web sphere can be seized by spontaneous or organized participants, diverted from its initial focal point while retaining a certain temporal unity and thematic coherence. Finally, the particularity of controversies in the context of web spheres is that they leave digital traces that can be massively and asynchronously collected and processed using *digital methods* (Rogers, 2013). These traces are composed of *texts* and *relations* that evolve slowly. From these three components (*texts*, *relations*, *time*) it is possible to follow and analyze political controversies and debates in a way that is both holistic and nuanced to unearth the diverse spectrum of dynamics. Of course, the implementation of such digital methods also poses a series of new and important epistemological and methodological problems identified in the literature (Rieder & Röhle, 2012).

Nevertheless, investigating the web's textual traces can be an advantage for the researcher, as it allows for a macroscopic perspective on online social media that would be practically impossible with traditional social science methods (Cointet & Parasio, 2019). The other advantage is the spontaneity of the texts and relationships collected, compared to data obtained through questionnaires and interviews. The latter is the result of the researcher's solicitation of an individual and the individual's acceptance to participate in the survey and *declare* their practices, preferences or relationships, with all the biases that this approach may include (Ratinaud et al., 2019).

However, this approach also implies a series of choices on the part of the researcher that must be justified. Indeed, a web sphere does not exist *in vitro*. There is no central authority that defines its contours or duration. It is the result of a necessarily partial observation, while the spaces from which we gather data are governed by platforms' logics, affordances, algorithmic architecture, etc. (Bucher & Helmond, 2018). What is more, as the recent debacle with Twitter hindering researchers' access to data demonstrates, digital methods, especially related to social media platforms, are asymmetrically contingent on platforms' governing rules and their executives' whims (Hendrix, 2023; Leerssen, 2021). As such, it is impossible to have an infallible or exhaustive overview, despite the illusion that very large data corpora can create. Thus, the limits set by the researcher, platforms' governance, and our own biases, must always be considered.

SAMPLING AND ANALYSIS METHOD

Our main focal point is the web sphere created on Twitter around Didier Raoult from a sample of 1.2 million tweets published by 251,532 unique users. We opted for keyword sampling using the free software DMI-TCAT, which uses the Twitter API (Borra & Rieder, 2014). We collected tweets using the term “raoult” over three months (30 March to 30 June 2020). The choice of the term “raoult,” rather than “HCQ”, for example, was preferred to have a broader spectrum of discourse rather than just the “technical” debate about the efficacy of the substance in question. The starting date of our inquiry was decided due to a restriction of DMI-TCAT, which allows for a synchronous collection of data and not a retroactive one. The end date was chosen to cover the lockdown period and its aftermath to capture the controversy’s evolution over a substantial period. For comparison’s sake, we decided to divide our sample into three distinct corpora, each corresponding to a month (April, May, and June).⁵

For the analysis, we followed a research protocol that has been successfully implemented in previous studies (Smyrnaiois & Ratinaud, 2014). Effectively, this allows us to identify communities of users within Twitter - constituted from online interactions (relationships) and to highlight, dynamically, the main themes prioritized by each of these communities (texts) and their evolution over time.

First, we constructed the directed graph of retweets and mentions from each corpus. In this process, Twitter accounts are treated as nodes of a graph and when one account retweets or mentions another, an edge of the graph (i.e., a link between the two accounts) is generated. Due to hardware limitations, we had to restrict this analysis to the 50,000 accounts that received the most mentions (retweets and replies) in the sample, allowing us to focus on the most active accounts in the debates around Didier Raoult. Once the graph was computed, we used the free software Gephi (Bastian et al., 2009) to generate a visualization. We applied the OpenOrd positioning algorithm to obtain a spatialization of the accounts while considering the strength of the edges between the nodes.

The topology of the graph is thus the result of the interactions’ intensity between the accounts (the more two accounts are characterized by a strong bidirectional interaction, the closer they are in the graph). The last part of

5. Due to a server failure, our collection stopped between 18-26 April. The first corpus therefore includes 23 days (from 30 March to 17 April and from 26 to 30 April), the second 31 days (from 1 to 31 May) and the third 30 days (from 1 to 13 June).

this first step consists of searching for the different communities inside this graph using the Leuven algorithm implemented in Gephi (Blondel et al., 2008); this determines sets of nodes that tend to be strongly connected. In other words, the process highlights clusters of Twitter accounts that retweet and/or reply to each other a lot. By closely examining the profiles of the most cited accounts within these groups we were able to infer their composition.⁶

The second step consists of a lexicometric analysis of the tweets contained in each corpus of three months involved. These corpora are analyzed with the Reinert method (Reinert, 1990) implemented in the free software IRaMuTeQ (Ratinaud, 2009). This method makes it possible to determine the different themes that structure a textual corpus. It is based on a descending hierarchical classification (DHC) that recurrently splinters the corpus into several textual clusters (text segments) based on factorial correspondence analysis. The final classes that are produced contain a list of words and phrases that were more prevalent in their constituting text segments compared to all other classes (based on their chi2).⁷ The “lexical worlds” (Reinert, 1990) that emerge through these *discourse classes* then contain the different themes addressed in the corpus, which are visualized as a dendrogram. In this article, we have restricted the visualizations to include only the most important classes for our analysis. In addition, IRaMuTeQ also identifies *characteristic segments* for each class, in this case, tweets, which include the most often used words in the corpus. This option enabled us to identify the tweets containing words that were used with significant frequency in each lexical class generated by the DHC analysis. We cite these tweets in the results section for readers to have a concrete understanding of the main discursive frames that were developed.

The last step in our analysis was to evaluate the degree of over- and under-representation of each user community within the discourse classes. In this way, we can assess which themes were prioritized and, conversely, which were ignored by each community. To do this, we calculated the relationship between communities and discourse classes (expressed by a chi2): the higher the chi2, the more tweets from the community are represented in a particular discourse class.

6. The effectiveness of this “manual” characterization method has been demonstrated elsewhere. See Fraiser et al., 2018.

7. Chi2 is used to measure a statistical dependence between the terms of two categorical variables. Here, it is used to estimate the relationship between user communities and discourse clusters.

THE RESULTS

General overview

In the first corpus (23 days - April) we collected 428,696 tweets including the term “raoult” from 136,063 unique users. 34% of tweets contained a link, meaning that they were mainly comments that referred to external sources. In addition, 73% of messages were retweets and 14% were replies. For comparison, for the second corpus (31 days - May) we collected 454,303 tweets from 124,802 users and for the third corpus (30 days - June) we collected 317,066 messages from 86,109 users.

Table 1: *Overall summary of the three corpora*

| | Tweets | Users | Average tweets/day | Average users/day | Average users/tweets | % links |
|-------|---------|---------|--------------------|-------------------|----------------------|---------|
| April | 428 696 | 136 063 | 18 639 | 5 916 | 3,1 | 34% |
| May | 454 303 | 124 802 | 14 655 | 4 025 | 3,6 | 31% |
| June | 317 066 | 86 109 | 10 569 | 2 870 | 3,7 | 26% |

However, if the proportion of retweets and replies remains stable, as we can see in Table 1, a drop of more than 25% in the average number of tweets per day is noted between April and June; the number of users involved is reduced by almost 50% over this interval. This can be explained by a decrease in the interest of Twitter users in the topic of the pandemic following the end of the lockdown in mid-May. But these figures may also indicate a progressive apathy towards Raoult. Moreover, between April and June, we observe a slight increase in the average number of tweets per user and a significant decrease in the percentage of tweets containing links to other sources. This may also suggest the polarization of the debate, where only a few more vocal people participated – and who used external sources to support their arguments.

The curve of tweets’ production (Graph 1) illustrates the connection between controversies on Twitter to media news. Thus, the peak moments in tweets’ production correspond to media interviews with Didier Raoult (29 April, 26 May, 3 and 25 June). Other important moments concern the publication of a video announcing the results of a study conducted by Raoult’s team, supposedly, confirming the efficacy of HCQ therapy (31

March). Politicians, Emmanuel Macron in particular, also seemed to want to benefit from Raoult's popularity. In both cases, the numerous media and political references to Raoult, despite their critique, strengthened his visibility, providing him with a certain credibility and influence on the handling of the pandemic.

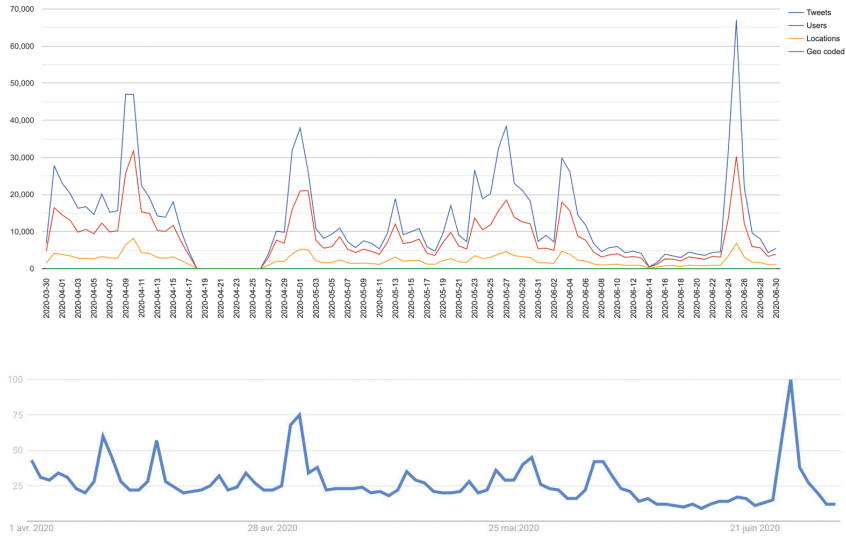


Figure 1: Evolution of the number of tweets and the number of queries containing the term “raoult” during the study period. The string “Geo code”, which can be used to determine the location of the tweets, was not used since the tweets were collected according to whether they contained the term “raoult” or not (Source: DMI-TCAT/authors and Google Trends).

THE NETWORKS OF ACTORS

For April, we can see the accounts of Didier Raoult and Emmanuel Macron, who met on 9 April, at the centre of the graph produced by the network analysis (Graph 2). A group of users (black colour) is formed around them, representing 11.15% of this sample of the top 50,000 users, who reacted to this meeting. Among them, we identified controversial popular accounts (such as the entrepreneurs/pundits Laurent Alexandre and Idriss Berkane), as well as numerous right-wing users. The accounts of Marine Le Pen and the far-right party Rassemblement National (ex-National Front) were also frequently cited.

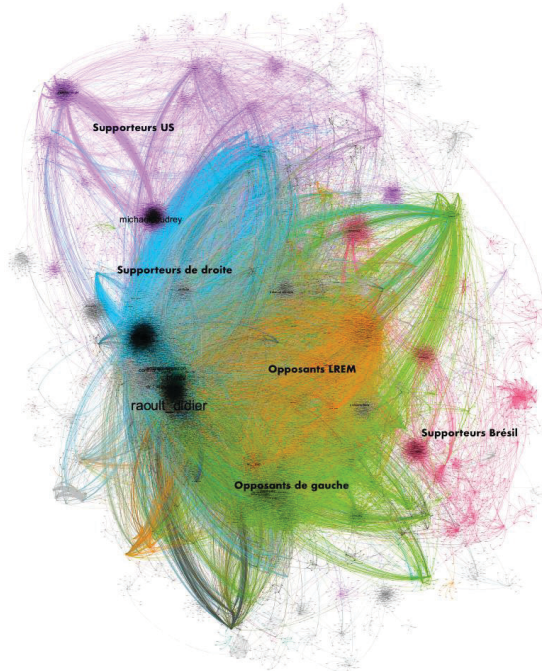


Figure 2: *The network of mentions between the 50,000 accounts that received the most retweets and mentions between 3/30 and 4/31 2020*

At the top part of the graph, we find Raoult’s supporters, whose political orientation ranges from the conservative right to the far-right. One of these groups (12.14% of the sample, in blue, at the centre-top of the graph), is essentially made up of accounts belonging to right-wing politicians and media (Les Républicains political party, Valeurs Actuelles magazine). This group is very close to the purple group at the top of the graph (the largest, with 13.46% of the sample) which is English-speaking and includes Trump and his supporters like Fox News’ Tucker Carlson and entrepreneur-activist Mike Coudrey. We must also add to Raoult’s supporters the group in dark pink at the bottom right of the graph which is Portuguese-speaking (4.94% of the sample) and which mainly includes supporters of Bolsonaro and media from Brazil.

On the other hand, there were two groups of Raoult’s critics, one on the left and one on the (pro-government) centre-right. The first group (green, 12.78% of the sample) includes accounts of scientists, doctors, and progressive online media committed to fighting scientific misinformation (independent websites Mediapart and Slate). The second group (orange, 7.71% of the sample) comprises accounts that support Macron and his

party, as well as a few legacy media outlets like the magazine *Paris Match* and RTL radio. There are also two small groups at the centre of the graph referring to media, one representing the audiovisual sector (BFMTV-whose journalist Apolline de Malherbe interviewed Raoult on 30 April, the account of Cyril Hanouna's popular TV show that supported Raoult on 15 April-, the TV news channel CNews and Europe 1 radio) and one representing the press (*Le Parisien*, *Le Monde* and *Les Échos* daily newspapers etc.).

In May, the structure of the mentions' network remained relatively stable (Figure 3). The main change was that in the central group including Raoult's account (in light mauve in the centre and left of the graph, 16.06% of the sample), a group of accounts commenting on two major media events is clustered together: Professor Raoult's interview with David Pujadas on LCI TV news channel and the publication of a study questioning the effectiveness of HCQ by the scientific journal *The Lancet*, which has since been retracted due to doubts concerning its validity. The most quoted accounts in this group include doctors and scientists criticizing Raoult.

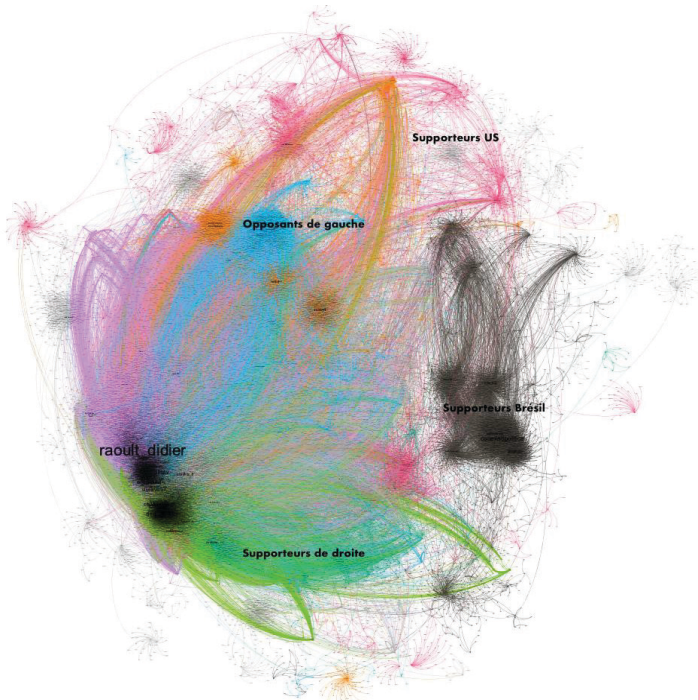


Figure 3: *The network of mentions between the 50,000 accounts that received the most retweets and mentions between 01/5 and 31/5 2020*

In green, and at the bottom of the graph, we find the block of Raoult's right-wing supporters (13.46% of the sample) with the same protagonists as in April, plus a few conservative intellectuals, journalists, and outlets founded by former National Front executives. We, thus, observe a convergence between the French supporters of Raoult that ranges from the parliamentary right to the far-right close to Marine Le Pen, as well as the new conservative politicians, close to the "Republican Spring" movement (Amselle, 2017). This group is close to the Portuguese-speaking group of Bolsonaro supporters (in dark grey on the right of the graph), which is itself connected to the community of Trump supporters (in red, scattered between the top and middle of the graph). The combined size of these two non-French speaking and politically far-right groups exhibits a decrease compared to April but remains important with 10.88% and 5.49% of the sample respectively.

Another group, found in our May corpus, is Raoult's progressive critics (orange at the top of the graph, 8.32% of the sample). This group is structured around Clément Viktorovitch, a political scientist and pundit in the daily program *La Clique* on Canal+ TV channel. Clément Viktorovitch is known for deconstructing the discourse of political speech and had devoted two critical columns to Raoult, including one broadcast on 28 May, in which he commented on his speech during the interview given to David Pujadas. In the same group, we found journalists from centre-left media such as *Le Monde*, *Médiapart*, and public service radios *France Inter* and *France Culture*. As before, in May, the *mainstream* media constitute two distinct, relatively large groups: one around BFMTV, *Le Parisien* or *Le Figaro* (blue in the centre of the graph, 11.48% of the sample) and one around CNews, TF1 and LCI (light grey in the centre, 3.01% of the sample).

However, the real novelty in the analysis of the May data is the appearance of a relatively small but significant community consisting of accounts of the conspiracy-oriented extreme right which stands out (small group in red below the cluster around Raoult's account, 3.61% of the sample). Here, we identified Alain Soral, a notorious anti-Semite, founder of *Egalité et Réconciliation* network, anti-vaccine and Covid-sceptic accounts, as well as the site of *MesOpinions.com* where several pro-Raoult petitions were hosted.

In the analysis of our June dataset (Graph 4), this group of far-right conspiracists remained present in the same proportions (a small cluster in light pink which stands out at the bottom of the graph and represents 3.6% of the sample). Not far from them, we also find the group of pro-

Raoult conservatives, which in this instance includes the right and the “institutional” far-right (dark purple, at the centre and bottom right of the graph) and which grew in proportion representing 15.14% of the sample. In addition to the members already identified, we also find executives of the nationalist party “Rassemblement National” (like Jean Massiha and Gilbert Collard), as well as the leader of the nationalist party “Debout la France,” Nicolas Dupont-Aignan.

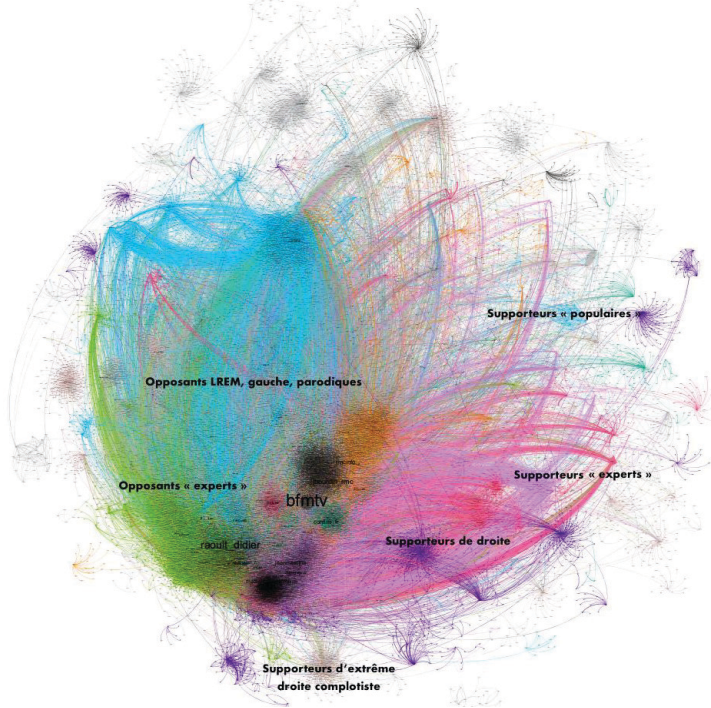


Figure 4: *The network of mentions between the 50,000 accounts that received the most retweets and mentions between 01/6 and 30/6 2020*

What makes our June dataset stand out is that the ranks of the pro-Raoult users grew among the 50,000 most mentioned users to include three additional groups: first, a group of supporters that can be qualified as “experts,” commenting on the grounds of their supposed scientific expertise (dark fuchsia at the bottom right of the graph, 6.03% of the sample). Then, we identified a pro-Raoult group that can be qualified as “popular” (light blue at the right of the graph, 4.59% of the sample) because its constituents primarily quoted accounts based on the popularity of those cited. Finally, a

last important group of Raoult's supporters is clustered around the account of the RMC radio journalist Jean-Jacques Bourdin, who interviewed Raoult on BFMTV on 25 June and his partner's account, also a journalist, Anne Nivat (in orange at the centre of the graph, 7.57% of the sample). Among the most cited in this group are accounts with a large audience close to the Rassemblement National, as well as accounts close to the Yellow Vests movement. It is worth mentioning that in June there is still the English-speaking group of Trump supporters but it has shrunk significantly (3.07%) while the Portuguese-speaking group has disappeared.

Two groups of critics stand out from the pro-Raoult group. The first, at the heart of the graph (dark green, 11.9% of the sample), includes expert profiles (doctors, researchers, scientific popularizers). The second one cites parody and satirical accounts, a sign that some users started treating Raoult as a "cult" media personality, subject to mockery and parodies. It also includes supporters of the government and mainstream media like *Libération* and *Le Monde*.

To conclude this section, we want to emphasize three important elements. The first is that the controversy around Raoult had a strong influence in the Twitter-sphere of the United States and Brazil, countries in which the far-right governments of Trump and Bolsonaro used the supposed efficacy of HCQ as an argument to support their laissez-faire policies, refusing to apply strong restrictions to counter the pandemic, especially in its early period. Transatlantic support for Didier Raoult and his therapeutic proposal on Twitter, however, decreased between April and June. In France, on the contrary, we observe the opposite trend: the proportion of groups that cite accounts friendly to Raoult increased in June in our sample, reaching more than 40% of the 50,000, including English speakers and 37% without them. For comparison, this percentage, only among French-speaking users, did not exceed 15% in the previous months.

At the same time, the proportion of groups that cite accounts critical of Raoult increased from 20% in April to 27% in June. This increase in both pro- and anti-Raoult groups came at the expense of the "neutral" groups that were clustered around *mainstream* media accounts before June. This element confirms the hypothesis we formulated in the previous section of a reinforced polarization around Raoult and his controversial proposals. We can trace the tipping point of this phenomenon at the end of May, which coincides with the publication of the article in *The Lancet* (and its subsequent retraction), which may have provided arguments to both sides. Finally, we also observe that the positioning of the different clusters of

users is strongly polarized politically: on the one hand, the supporters of Raoult gathered around the accounts of right-wing or even far-right political figures, while the critics tend to mention personalities from the centre or the left.

THE DISCOURSE

First, the lexicometric analysis of the tweets published in April (Figure 5) highlights two classes of non-French speech: class 14 (English) and class 13 (Portuguese), which correspond to groups of supporters of Trump and Bolsonaro respectively, representing only 3% of the corpus. We also noted the existence of three important classes in terms of size: class 1 (24% of the corpus), class 2 (15.5%) and class 3 (14.9%).

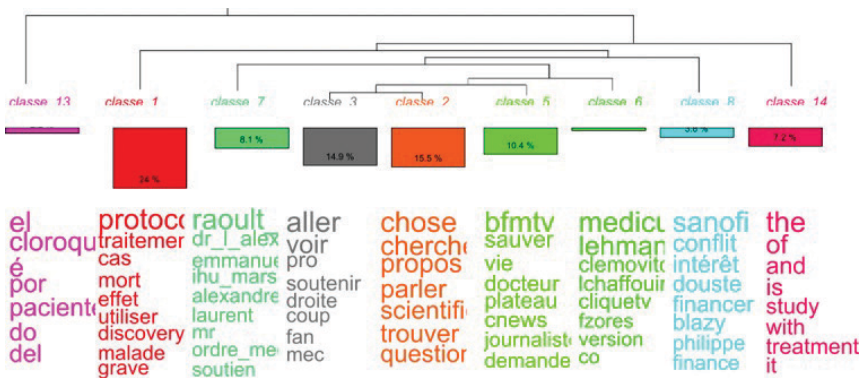


Figure 5: *The discourse classes produced by the 50,000 accounts that received the most RTs and responses between 30/03 and 30/4 2020 (to improve the visibility of the graph we have kept here the 9 most important classes out of the 14 produced by the lexicometric analysis)*

Class 1 is rather descriptive, as it contains tweets referring to the HCQ treatment, its scientific protocols, to the European “DisCoVeRy” study,⁸ as well as to various indicators (e.g., mortality rate, number of patients, etc.). Yet, we see no signs of polarization around Raoult or his treatment proposal, nor elements of a critique of the political management of the health crisis. The groups that are over-represented in this class mostly

8. <https://beta.clinicaltrials.gov/study/NCT04315948>

refer to the meeting of Macron with Raoult and to the latter's right-wing supporters.

Moreover, we infer that, in our April dataset, these groups mostly agree one with another. However, we can also observe a form of politicization of the subject. Specifically, the group that refers to the Macron-Raoult meeting is over-represented in class 7, where we find messages like *"Prof. Raoult [Macron] had no other choice but to come and meet you because the people are with you, it is his strategy to gain a few more voters simply. The cards are in your hands"*.

The group of Raoult's supporters quoting right-wing figures is also over-represented in class 8, in which the pharmaceutical industry is mentioned as well: *"The Raoult affair, or the covert war between Sanofi and the American laboratories"*. There is thus initial political speculation on the subject that goes beyond the purely scientific dimension (e.g., the geopolitical relationship between Europe and the US, the power of the pharmaceutical industry, conflicts of interest or corruption of experts). Moreover, in this class we find the hashtag *#stopconfinement*, hinting at the opposition of this group to the lockdown.

The second largest class in size is class 2, which includes words like *ethics, quack, fraud, credibility, deceive, and ego*. Unsurprisingly, the groups over-represented in this class are scientists and doctors committed to fighting scientific misinformation, the left-wing media, as well as liberal and pro-government voices criticizing Raoult. A tweet from this class reads: *"This methodological debate is interesting and [demonstrates] a deep scientific controversy"* or *"With hydroxychloroquine Raoult sows hope and reaps scientific ruckus"*. The premises of the scientific controversy that would later grow with the publication of *The Lancet* can be found in this class, suggesting that, in some circles, the debate had begun in April.

The two groups opposing Raoult are also over-represented in class 3, referring to the political aspects of the debate. A tweet from this class reads: *"It's all politicized, Raoult has fans in the RN [Rassemblement National] and the right-wing"*. The word "conspiracy" is significantly present in this class. Our interpretation of the corpus confirms that the supposedly conspiratorial nature of the theories developed both by pro- and anti-Raoult is an important issue in the discourse. A revealing example from this class is the following: *"Raoult is defended by Bernard-Henri Levy, Estrosi, Meyer Habib, he speaks every day with Macron and his wife, LREM [La République en Marche] or LR deputies have asked for his treatment, and people] come and say that it is an anti-Marseille conspiracy by the*

media...”. Unsurprisingly, the group of scientific and left-wing critics is also over-represented in class 6, which mainly consists of condemning Raoult’s misleading rhetoric, based on a piece by Clément Viktorovitch that appeared on Canal+ on 28 April.

The lexicometric analysis of tweets published in May (Graph 6) shows a discourse like that of April, with the exception that there exists a greater number of small classes. We still find the English-speaking class (17), but the Portuguese one has been greatly reduced. Here, we also find the descriptive class mentioned previously (Class 1), which remains the largest one, comprising 23.6% of the corpus.

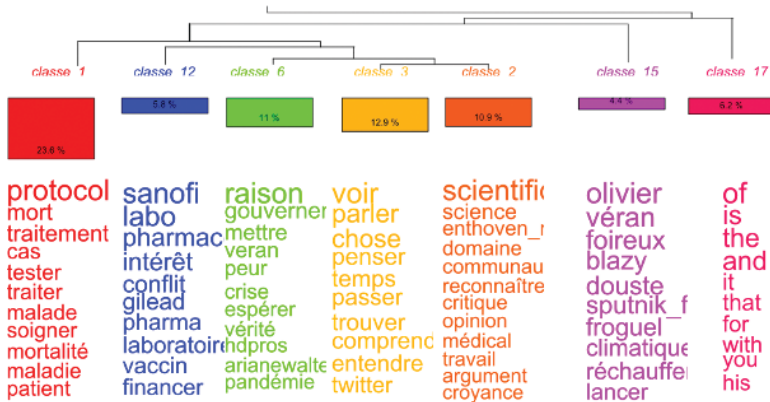


Figure 6: The speech classes produced by the 50,000 accounts that received the most RTs and responses between 01/05 and 31/5 2020 (to improve the visibility of the graph we have kept here the 7 most important classes out of the 17 produced by the lexicometric analysis)

The second largest class is class 3 (12.9%), which includes a kind of meta-discourse regarding the terms of the debate itself. For example, one tweet reads: “*From Ferrand to Raoult, from my sister to my grocer, the great common point is to speak on behalf of the people, everyone says what the people think*”. The over-represented group in this class contains Raoult’s opponents, who convene around the account of Clément Viktorovitch and the program La Clique TV, as well as that of La Méthode Scientifique, a program of France Culture which also pointed out Raoult’s inconsistencies. This same group is also over-represented in class 2 (10.9% of the corpus), the fourth largest class, which also refers to Canal+ and France Culture programs, as this tweet shows: “*The interest that I myself had for Raoult at the beginning is giving way to a lot of scepticism, there*

is some truth in his criticism but a lot of inconsistencies in what he says". Thus, this class is very critical of Raoult, who is described with derogatory terms like "charlatan".

On the other hand, the group of conservative supporters of Raoult is mainly over-represented in class 15, which includes the reactions triggered by the decision of Health Minister Olivier Veran to suspend the HCQ's treatment protocol, following the publication of *The Lancet's* study: "*Olivier Veran settles his accounts with Didier Raoult and his comments, this is not very responsible.*" This group is also over-represented in class 12, which refers to the pharmaceutical's industry interest in validating a hypothetical treatment: "*Prof. Raoult is very disturbing to all those ministers who have interests with the Redemsivir pharmaceutical labs and vaccines,*" says a user of this group. It is interesting to note that the second over-represented group in this class is that of the far-right conspiracists, who gathered around Alain Soral. For them, the power of influence of the pharmaceutical industry becomes the main framing to explain political decisions: "*Dr Raoult's treatment does not benefit the Big Pharm*" notes one user.

The same group is also over-represented in class 6, which contains harsh criticism of the French government, as this tweet demonstrates: "*Raoult was right all along, the government was wrong and must resign.*" Another characteristic example is the following: "*Raoult is David against Goliath, if the pharmaceutical powers win it's the end of our health and our freedom, for which they don't care. Our infamous government and our president are clearly on the side of these powers.*"

The lexicometric analysis of tweets published in June (Graph 7) reveals a discourse that is significantly different from that of April and May. First, we find a distinct class (3) made up of offensive language, which even if limited in volume, signifies a notable tension in the exchanges. Moreover, we do not find the large descriptive class (1) that previously represented a quarter of the corpus. The most important class of the corpus is class 5 (18.2%), which contains a discussion about scientific research and the credibility of studies, fueled by the withdrawal of *The Lancet's* article, but also by revelations concerning Raoult's publications.

For example, one tweet reads: "*Science is not a matter of opinion. Raoult is scientifically wrong, period. Either you accept it or you don't, but if you don't accept it you are in blind belief.*" Not surprisingly, "expert" opponents (e.g., doctors, researchers, scientists) who are very critical of Raoult's treatment proposal are over-represented in this class, as well as in

class 6, which is very close thematically and important in terms of volume (12.6%).

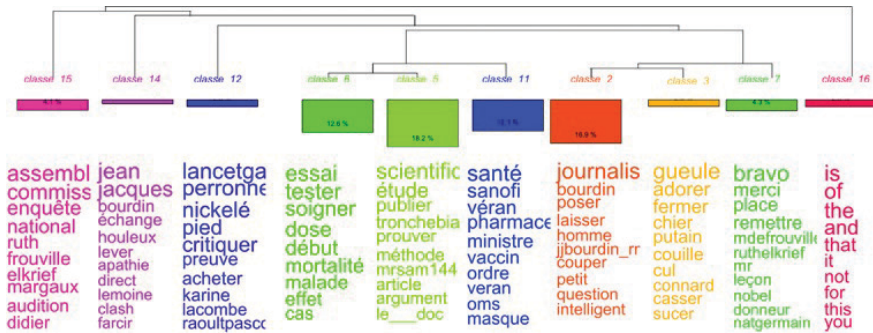


Figure 7: The discourse classes produced by the 50,000 accounts that received the most RTs and responses between 01/06 and 30/6 2020 (to improve the visibility of the graph we have kept here the 10 most important classes out of the 16 produced by the lexicometric analysis)

Raoult’s right-wing supporters seem to use a particular vocabulary in this period. Their group is over-represented in class 7, which consists of comments on Raoult’s interview with journalists Margaux de Frouville and Ruth Elkrief on BFMTV on 3 June. Expectedly, most of the comments are critical of the journalists, as shown here: “@mdfrouville You stepped out of your role with Dr. Raoult and it was very polite of him to only tell you to shut up”. Generally, this class contains a discourse of gratitude towards Raoult for putting the journalists in “their place” during the program. The group in question is also over-represented in class 2, the second largest (16.9% of the corpus), which, like class 14, focuses primarily on Raoult’s interview with Jean-Jacques Bourdin on RMC radio and BFMTV on 25 June. There are also comments critical of the journalists’ stance towards Raoult.

Raoult’s supporters, who lean towards right-wing figures are also over-represented in classes 11 and 12, in which they talk about the economic interests of the pharmaceutical industry and the corruption of experts. For instance, one tweet reads: “Raoult brilliantly denounces the ruinous and disastrous conflicts of interest between the all-powerful and hyper-profitable pharmaceutical industry and certain great French scientists, whatever one thinks of him, that is already a great accomplishment”. Similarly, another reads: “Those who criticize Raoult’s protocol despite the evidence are bought by the laboratories.”

Furthermore, in class 15, we find an over-representation of one group that was clustered around extreme right-wing conspiracy supporters, who were supportive of Raoult. Its discourse is centred on the testimony of Raoult before the Commission of Inquiry of the National Assembly. We read, for instance: *“I have just listened to Didier Raoult answering the commission of inquiry of the national assembly, it is egregious if a revolution does not start after that. We are near a definitive dictatorship, this guy is extraordinary, a synthesis of the French spirit”*. Likewise: *“This parliamentary commission is a masquerade, Professor Raoult denounces a scandal and still nothing will change”*.

CONCLUSION

The controversy surrounding Professor Didier Raoult’s Covid-19 treatment proposal brought about the public foregrounding of the long and arduous process required to infer a scientific consensus on a complex question. This controversy perfectly illustrates Latour and Woolgar’s (1986) seminal idea, that scientific facts are socially constructed and that their establishment depends on specific routines and practices, like the functioning of laboratories and the publication of scientific articles; on the notoriety of researchers and the financial means they have at their disposal, as well as on broader political issues like the public opinion at a specific historical juncture. What is surprising in the case of Didier Raoult and the HCQ is that the context of the pandemic and the almost exclusive focus of the public debate on relevant issues exerted very strong pressure on the regular processes of research. This generated an intense interference of the scientific field with the political and media system, albeit for a very short time.

In this article, we attempted to analyze this controversy, which took place under these particular conditions on Twitter, by applying an innovative research method. We tried to study the connections between actors that constructed the online discourse around Raoult, as well as to understand their evolution over time. We initially set three hypotheses on this subject. The first was, that the publication of tweets about Raoult would closely follow the media and political agenda by involving many journalists, media, and political accounts, both national and international ones. This hypothesis was proven true: the publication of tweets peaked at the same moments as important media events (e.g., interviews with Raoult, meetings with politicians, etc.).

Moreover, many groups clustered around media and political accounts that received numerous mentions (e.g., criticisms, comments, etc.). This

demonstrates the complexification of the contemporary public sphere and the functional integration of social media into the media system. This was not restricted to France but expanded abroad and, in particular, in two countries, the US and Brazil, where the proposal to use HCQ to treat Covid-19 had become a political issue of primary importance because it has been instrumentalized to justify the non-interventionist policies of Trump and Bolsonaro. The relevant accompanying argument was that: “if there is an effective treatment for Covid-19, then the population should not be confined, and the economy should not be stopped.” Notably, supporter groups of Trump and Bolsonaro consistently connected with French-speaking pro-Raoult groups on Twitter, illustrating the international nature of the digital public sphere.

Our second hypothesis was, that the controversy surrounding Raoult’s personality and his proposal was not simply the result of anti-scientific beliefs combined with conspiracy theories. Conversely, we suggested that this controversy expressed, at least in part, a contestation of the neoliberal paradigm. Our investigation allowed us to confirm this hypothesis because the arguments advanced by the pro-Raoult users did not cease to link this affair to the political and economic context of the current historical juncture.

Indeed, the stories that have been told on this subject are quite typical of contemporary controversies, often labelled as populism, opposing the “people” to the “elites.” On the one hand, those who question the validity of Raoult’s arguments are doctors, researchers, and specialized journalists, who mobilize arguments of a scientific and technical nature (notably concerning the validity of the Raoult team’s study protocols). But, alongside them, we also find politicians, journalists, and prominent personalities, who are well integrated in the spheres of power and who are accused by supporters of Raoult of being in the payroll of the French government and the pharmaceutical industry. Didier Raoult, thus, was elevated by some people to a kind of popular hero trying to save the people from the pandemic, while fighting against the “Parisian establishment” and the billionaires, owners of the pharmaceutical industry, and the media.

Regardless of this argument’s apparent weaknesses, it nonetheless constitutes a critique of the political economy of neoliberalism and its impasses (i.e., widening inequalities, opacity of power, democratic weakness, economic concentration). In this respect, we also conclude that it is relatively ineffective to limit critique of this kind of discourse to verifying what is said in social media (*fact-checking*) or to debunking conspiracy

theories, without questioning the technocratic denial to acknowledge the interference of politics in science or economics (Monod, 2017).

Finally, our last hypothesis, which expands on the previous one, was that the arena of discursive deliberation and contestation is far from the typical ideal of the public sphere intended to form consensus through a process of democratic deliberation based on the use of rational arguments. Indeed, we found several indications that hint at this direction. For example, in the case under study here, it seems impossible to separate the scientific debate on the effectiveness of the HCQ against Covid-19 from the one concerning Raoult's personality. This is because, on Twitter, contrary to the theoretical principles of rational discussion in a deliberative process, there is a constant confusion between *ad rem* arguments, i.e., dealing with the facts, and *ad personam*, i.e., dealing with the author of a discourse on the facts.

Additionally, a multitude of actors partake in the discussion with their agenda and do not hesitate to instrumentalize the fears and concerns of people to pursue their political objectives. In our study, this is the case of actors close to the French government, trying to justify their demeanour in the framing of the pandemic's management. More importantly, though, this also applies to extreme-right groups, who are sometimes openly racist, homophobic, and anti-Semitic, spreading misinformation, while instrumentalizing dramatic events for political gains.

In conclusion, this article attempted to identify the dynamics of a complex political and scientific controversy within Twitter, only a few months after it reached its peak in terms of media relevance, with the topic of the Covid-19 pandemic headlining the news. We believe that our work is important in that it can illuminate the debate dynamically, while enriching it with concrete findings stemming from our rigorous methodological approach. Two important limitations of our approach are the, essentially, quantitative method followed and the specific characteristics of Twitter. Indeed, we have expressed important epistemological caveats on this subject earlier in the text. To this end, in the future, it would be appropriate to deepen our analysis with the implementation of more qualitative tools, as well as to expand it to other media characterized by different uses and audiences. This would allow us to obtain a holistic understanding of the phenomenon studied.

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