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RESEARCH ARTICLE

The Scientific Controversy on Covid-19 and the Image of Science as an Expert System: Comparing the Debate in Italy and UK

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ABSTRACT:

The theoretical context of this article refers to the relations between expert systems and public opinion, according to an approach that describes how scientists' knowledge is questioned during serious globalized crises, such as epidemics and pandemics. In this regard, a typology of Italian and UK Twitter profiles was proposed in order to define the role of scientists in the debate around Covid-19, and to answer to what appear to be relevant research questions: What are the main scientific issues of the controversy? How is shaped the multifaceted pro-vax front? What image of science as an expert system emerges in the debate on Covid-19? To do that, a web-ethnography was performed, based on the analysis of some Italian/UK Twitter profiles of scientists, analysing a selection of interactions generated around them. The main research results are presented with reference to 'pro-vax' emerging profiles (a less studied context than the 'anti-vax' front), trying to illustrate the complexity of the dispute and the adequacy of discourse about science. In the end, the authors suggest that the idea of science as a 'truth' that people should simply trust - overly simplistic in the past - is not entirely plausible in today's public debate in social networks.

KEYWORDS:

Controversy; Covid-19; expert systems; scientific method; social media; social network

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1. Introduction

From the very beginning of the Covid-19 pandemic, it was clear that the public and policymakers would place their trust in science and scientists in particular. "Follow the science" has become a mantra in the mainstream political debate (Safford et al. 2021). Such a situation had multifactorial reasons (e.g. crisis of confidence in politics, the spread of a pandemic overtaking national authorities...), but also consequences. One of them is the overexposure of people to science. Scientists and researchers, more used to laboratory, suddenly became very popular and subject of overwhelming expectation and, not so unexpectedly, criticism. Thus, if some of them decided to leave the field of public controversy, which sometimes became a battlefield, others decided to communicate directly with the public, using a relatively simple mode, social media, weathering the storm of comments and trying to navigate such a new sea. Our interest is to investigate what happened in that specific context and which attitude scientists have taken, without claiming to be very exhaustive, also in consideration of the nature of the methodology chosen.

This contribution first tries to define the limits of debate developed around vaccines and Covid-19 pandemic, by attempting to illustrate the terms of the related scientific controversy (Martin 2008; Gesser-Edelsburg et al. 2021; Pellizzoni and Biancheri 2021). The focus will be on the nature of scientific controversy, discussing also the existence of a controversy itself, the role of expert systems, expert systems and theoretical foundations of science, data interpretation and scientific literacy, abstract systems and trust (Alteri et al. 2021).

After explaining the methodology of analysis, the main results are presented with reference to pro-vaccine, 'pro-vax', emerging profiles, trying to illustrate the complexity of dispute and the adequacy of discourse about science. In the end, we suggest that the idea of science as a 'truth' that people should simply trust - overly simplistic in the past - is not plausible in today's public debate in social networks.

2. Theoretical contextualization: science, vaccines and expert systems

The debate on vaccines anti-Covid-19 concerns, besides other aspects, a scientific controversy about their efficacy, duration, danger of adverse effects. Specifically, the issue of vaccines had a prototypical value in the broader controversy originated around Covid-19.

After a first phase, when little or nothing was known about the new coronavirus and several so-called experts had been asked by press and TV, the restriction of citizens' freedom of movement - especially in Western countries - provoked consequences (Boccia Artieri et al. 2021).

Let's consider the so-called '*lockdown*' or confinement (i.e. the restriction of the citizens' personal freedom): a measure of isolation ('social distancing') aimed at containing the epidemic, which, in Western countries, has also constituted a real epistemological, cultural and political break with the recent past. Italy and the United Kingdom (UK), the two cases we are going to examine, have dealt with this containment measure in different ways. Since the pandemic outbreak, in fact, the UK government took a less restrictive approach than the Italian one, initially delaying containment measures and - as soon as contagion trends seemed to make it possible – easing restrictions on citizens' social life (see Table 1). In both cases, however, emergency legislation was imposed in a context, i.e. Western Europe, where similar restrictions had never been adopted in the post-World War II era. In essence, measures such as evening curfew were a collective memory of wartime, certainly not a living memory of Western Europe citizens accustomed to an essentially unrestricted model of movement.

Moreover, in the current debate, there is ambiguity about profiles and arguments that can be defined as pro-vax, with a synthesis that does not adequately account for it. This is only a label used to indicate those social

actors and arguments that, starting from an analysis of scientific data (medical, epidemiological, statistical and demographic, overall), support the vaccination strategy as the main measure, not the only one, to fight the spread of the SarsCov2. In other words, these positions in principle are not against public intervention to reduce the effects of Covid-19 pandemic. We therefore decide to use this label (pro-vax) also to underline the cleavage between the two sides of the controversy. Because that other side is generally defined by mainstream media as 'anti-vax' or 'no-vax', the opposite may be identified as 'pro-vax'. We are aware that it is a matter of: "a mass media artefact and does not account for the complexity of the debate on vaccines and immunization policies" (Gobo and Sena 2019: 176). We also are aware that what is generally referred to as 'vaccine hesitancy' (one of the global threats to world health, according to the WHO 2019) is a complicated social phaenomenon: it starts with the first human trials of vaccine during the 19th century and can be said to follow future developments in the coming vaccination campaigns (Durbach 2005). Furthermore, let's consider the so-called 'free-vax' movements that claim freedom not from all vaccination campaigns but only from compulsory ones. It does not seem proper, therefore, to encapsulate this stance in the 'no-vax' label.

However, we chose that cleavage (pro and no) to make clear that there is a conflict with contentious sides and also because the polarization became clear especially during the vaccination campaign in Italy and the UK. In previous months, based on our point of view on the debate in social media, the conflict was not so hard and the positions were generally milder: the introduction of vaccines had significantly changed the debate deepening the cleavage we can still observe. That fact should be related with other social challenges, among which we can mention "the crisis of public communication" (Alteri et al. 2021: 16).

Various observations have been made on how to characterise the profile of anti-vaccine (we call them starting from now as 'no-vax') world, its complexity, and the problematic nature of dichotomy itself (pro vs no). We just recall reflections on the hegemony of pro-vax position, even in a phase preceding the Covid-19 pandemic, and the risks of any reductionism of critical positions to the 'no-vax' label (Mele et al. 2021: 91; Vanderslott 2019). In particular, it should be avoided to include very different positions in a single category, with the intention, evident or not, of orienting a debate that is certainly not simple. It would be reductive to lump together those who pose legal problems with measures such as the *Green Pass* scheme (a certification for which freedom of movements depends on the vaccination status or negative test), those who do not trust the industrial practices of multinational pharmaceutical companies, and those who believe that there is a planetary conspiracy to eliminate a large part of humanity: it is a representation that serves essentially rhetorical purposes, but of little heuristic value.

In the analysis of conflict arisen within public opinion about the vaccine, it is worth remembering that the political debate is framed by a regulatory exception. It is what Giorgio Agamben (in the footsteps of Michel Foucault) describes as a 'state of exception' (Agamben 2005), a condition where legal order is not valid. A condition that some Western countries, among others, also adopted in the post-war period to face, for example, the challenge of terrorism. In addition, it is not a surprise if Agamben himself has now become an international political guide for the movement against containments measures.

It is, therefore, important to note that the discourse is not limited to a 'medical' discussion (e.g. which is the best vaccine to use, who should necessarily be vaccinated, what different measures should be taken, if any…). Rather, the issue concerns the very forms of participation in social life and potential conflicts between individual freedoms and the collective interest. Without taking into account, therefore, the context of general upheaval in previous standards of living (a freedom of movement that is essentially unrestricted), the nature of public discourse cannot be fully understood. The discussion about vaccines, a debate that has its own tradition preceding the Covid-19 pandemic (Blume 2006; Colombo and Rebughini 2006), is thus embedded in a broader framework.

In the next pages, we try to resume issues that seem inescapable to frame the public debate on Covid-19 vaccines. Nonetheless, we do not focus on other containment measures because they have been widely discussed, especially by political science because of their consequences in terms of personal freedom and relationship between citizens and public institutions. Instead, our focus is on the conflict between scientific discourse as an expert system and public opinion in the paradigmatic Covid-19 vaccine affair.

In this regard, a typology of the different profiles has been outlined in order to answer to what appear to be relevant research questions:

What are the main scientific issues of the controversy? How is shaped the multifaceted pro-vax front? Moreover, what image of science as an expert system emerges in the debate?

2.1 The scientific controversy (if any)

First, it is important to discuss the nature of the dispute, trying to prove that a dispute exists and what kind of dispute is. According to a classical approach (McMullin 1987: 51), a scientific controversy could be defined as a dispute "publicly and persistently maintained (…) concerned with a matter of belief" (Ivi). Moreover, a 'fundamental' controversy (a) is a dispute about the most significant aspects of science. *Au contraire*, a disagreement about the right and useful use of a scientific artefact (we may describe the use of vaccines in those terms) could not be strictly considered as a scientific controversy (b). Probably we can define the latter as a technological controversy, "a dispute over the introduction or consequences of technological systems or processes" (Martin 2008: 1). However, that is our first issue: contributing to give a proper place to the Covid-19 vaccine debate.

It is possible to give several examples of a scientific controversy (about the most significant aspects of science), but there are at least two different typologies of the fundamental one: (a.i) a methodological controversy and (a.ii) a controversy about the pillars, the fundamental assumptions, of a theory.

Regarding the first type of disagreement (a.i), the methodological one, we may recall the controversy on nature of social/human sciences, which took place in Germany in late 19th and early 20th century. The issue was about what can be the more strict and appropriate method (etymologically, the road to) for those form of knowledge in order to reach the truth. We may exemplify this controversy under the point of view of Economics, referring to Carl Menger's *Methodenstreit*. Nonetheless, it seems preferably starting with a classical sociological dualism: Durkheim versus Weber (Calhoun 2012).

Briefly, on the one hand, the Durkheimian model (a.i.i) of sociology assumes language and method from the sciences of nature, or hard sciences. In that perspective (*Positivism*), it is possible to talk about 'social facts' and we may call that as methodological monism (i.e. there is only a method in science). On the other hand, the Weberian model (a.i.ii) refers to Germanic historicism and maintains that methodology of social sciences fundamentally differs from the naturalistic one. In this respect, there are two different methodologies (methodological dualism) and it is possible to argue the existence of a specific method for the science of society, using, for instance, ideal types. This controversy, summarised in an excessively concise but hopefully respectful way for the masters of sociological thought (Aron 1967), presents a radical opposition on the nature of knowledge itself. In the context of hard sciences, even in recent times, such controversy occurs about subatomic physics, quantum theory and, in particular, *String Theory*.

The controversy on fundamentals (a.ii), instead, presents a prototype in the distinction between cosmology of Galileo (a.ii.i) and the Aristotelian-Tolemaic one (a.ii.ii), heliocentrism versus geocentrism. It is a controversy that, by interpreting in different ways what can be observed with senses (the movement of stars), questions the very methodology of what can be defined as science. In that dispute, two different principles of

science clashed: sensory experience (and thus the logic of experiments) and the principle of authority (i.e. the Latin *auctoritas*, the authority of classics, Aristotle, but also the theology built during the Middle Ages and, consequently, the order of the world). By the way, it is interesting to remember that in the ancient Rome (Cartabia 2020) *auctoritas* was distinct from *potestas*: this because the Senate (that we can define as an expert system, see below) had the maximum level of prestige and influence; indeed, power clearly belong to people (*potestas in populo*). In addition, the history of ancient Rome is notoriously rich in such disputes between élites and people.

Starting from that controversy about cosmology, philosophy and sociology of science had built an extremely relevant analysis on knowledge evolution. We may think about Kuhn's considerations on the structure of scientific revolutions (Kuhn 1996), but also Lakatos (1970) or Feyerabend (2018): in these works, it appears clear that cosmological controversy was a good starting point to understand the essence of modern science. The latter seems to be a social and historical product that can evolve, can be publicly discussed, can fall into error and be corrected. In this respect, following a constructivist interpretation of scientific activities, the *laboratory studies* (Knorr-Cetina 1983; Latour and Woolgar 2013) stress, among other things, the situated and dynamic nature of science as a sociotechnical construction thanks to the use of instruments that make scientific phenomena visible. This implies a knowledge that evolves on its own, through the innovation of observation technologies, but also through the modification of a prevailing paradigm (at a given time). A knowledge that does not have the character of eternity: So, who can call it 'the truth'?

In such a context, it is not surprising that the dynamic dimension of science would be one of the most relevant reasons behind doubts on vaccines. If science is, by its nature, changeable and subject to criticism (remember Popper's principle of falsification), is it possible to make apodictic statements about vaccines, such as "vaccines are safe"? Similarly, those who oppose to vaccines, especially those who are hostile to new-generation vaccines (such as mRNA vaccines), appeal to the precautionary principle, which requires a high degree of caution. Following this reasoning, new drugs may be considered insufficiently supported by scientific evidence if the authorisation procedures are not known with a high degree of accuracy. Furthermore, Foucault's lecture reminds us that the nature of human knowledge is historically contingent (Foucault 1969), and its origins can be found in positions of power. We note that it is one of the most emphasised arguments of the anti-vax front, the so-called 'experimental' status of Covid-19 vaccines.

For these reasons, the controversy on Covid-19 vaccines seems to be a dispute over the fair and effective use of them (the 'b' type of a controversy), also because criticism is oriented on methodological issues (e.g. short time to create new medicines). In any case, there is a relevant issue on the ground: the nature of expert systems.

2.2 The conflict on vaccines

As will indeed be shown through the analysis of the empirical material collected during the observation period (autumn-winter 2021), it is complex to attribute to Covid-19 vaccines dispute a clear character of controversy. In fact, by carefully analysing McMullin's statement, one can see that in his reflection a controversy is defined as "a public and persistently maintained dispute" (McMullin 1987: 51). As rough as this definition is, it seems possible to say that controversy on vaccines is coherent with McMullin definition: it is a public and persistent dispute (at the time of writing this article, although the vaccination campaigns have essentially ended, the controversy is still ongoing in social networks). Again, a scientific controversy "is concerned with a matter of belief" (Ivi). Both sides continue to claim to be right and that the other side is wrong (Ivi). Both sides claim knowledge. Eventually: each side of the dispute claims the authority of "science" for

their view. It does not appear that the dispute is just on the measures or actions to be taken; rather it seems clear that it rests on a difference in the assessment of the reasons for action.

If all this is acceptable, it seems important to assess the nature of debate to see whether it is a dispute over the use (b) of a technology (vaccines) or the very nature (a) of knowledge producing vaccines. Another hypothesis, not to be excluded, concerns the complexity of different and co-existing involved levels in the dispute on vaccines and other measures against Covid-19. Indeed, it is possible that in the vaccine controversy differences on the use of technology are involved at a first (lower) level, while, at a deeper level, there are different beliefs, a different way of seeing the world (*Weltanschauung*). This multi-level interpretation can certainly be corroborated by a well-known rhetoric in the public debate on vaccines. On the one hand, one challenges a specific technology (vaccines), but, on the other, one raises doubts on the entire structure of science and the methodology by which scientific research proceeds.

Finally, following this idea, one questions the very sources of scientific research, thinking about, for example, the influence of drug manufacturers and the role of 'pharmaceutical-industrial complex' in the search for new medicines (i.e. '*Big Pharma'*). The semi-quotation of Wright Mills is not accidental: debate dates back to the 1970s, but more recently it has been taken up by John Ehrenreich (2016) and explicitly evoked during the Covid-19 pandemic, when pharmaceutical companies and politicians have been accused of taking advantage of the emergency to accumulate profits at the expense of public sector (Sule 2021). The final step in this interpretation is the rise of 'alternative' scientists – supposedly without any economic interests – as opposed to the traditional scientific community. "The anti-vaccination movement often denigrates scientific studies (and the scientific method in general), while simultaneously craving scientific legitimacy for their theories that vaccines are harmful" (Kata 2012: 3781). This narrative, 'skewing the science' (Concer 2017), is often a manifestation of a truly alternative approach to health, which refers to medicines other than conventional ones. In this sense, we are dealing with a different way of seeing the world, an alternative way to the so-called mainstream.

2.3 A new political cleavage

A further hypothesis – here we will partially deal with it – refers to the possible presence of a political conflict, strictly speaking. Again, some distinctions should be made. According to some points of view, sociological and philosophical literature argues for the existence of a political issue. Of course, we refer to the topic of biopolitics and the thought of Foucault mentioned above. Starting with the work of the Italian philosopher Agamben (2021), there have been several references to the 'state of exception' imposed under the guise of a pandemic crisis. According to some scholars, in fact, the pandemic, whether it exists or is just an invention of biopower to maintain its dominance, has created a: "state of exception (which) has led to an increase in biopolitical logic, where some lives have come to matter more than others" (Højme 2022: 1). According to Agamben, the reduction of citizens to a mere condition of biological life (bare life), in deference to the measures taken to contain the Covid-19 pandemic, seems to be, in Italy and the rest of the world, part of a more general process of 'biosecurity' (Agamben 1998). The logical conclusion of this conflict is a demand for political initiatives to overturn the liberal paradigm in the name of bare life towards a new form of bio-communism or, in other words, in order to fight the precarisation of working life and beyond (Butler 2004).

First of all, it should be clear that, in this case, it is not possible to draw a simple and unambiguous line as the traditional one (between left and right-wing or between progressives and conservatives). Moreover, it is not easy making comparisons within the international political scenario, neglecting national variables. However, there is another reason why the topic of political conflict can be legitimately introduced into the scientific controversy on vaccines, a reason linked to the fact that the two considered countries - Italy and the

UK - have a social structure not so different (at least, in term of way of life, certainly more similar in comparison with non-Western countries).

Nevertheless, despite similarities, it is possible to identify different political situations and different kind of government coalitions. On the one hand, during the hard times of pandemic Italy had two governments - one headed by Giuseppe Conte (Conte II), the other by Mario Draghi - with a common pro-European Union (EU) posture, not certainly right-wing (the closest example in Europe is Germany's Große Koalition). On the other hand, in the UK, at the same time, there were a conservative (centre-right) government explicitly sceptical towards Europe (the 2019 Tory electoral campaign was clearly against Brussels and in favour of an Atlantic political perspective). It is not the place for a politological discussion, but it seems to be emerging a new configuration of political cleavages in Europe, pro-Europe (as European Union) and counter-Europe (EU), overlapping and perhaps replacing the traditional one (since the 19th century) between left and right (Ford and Jennings 2020). However, it can be reasonably argued that these are governments with different underlying options. Most importantly, the UK side shows its distinction from Europe as a whole, and Italy in particular, in taking sanitary measures to contain outbreaks. In other words, the UK wants to emphasise its sensitivity to the fundamental freedoms of people, and for this reason has chosen an unrestricted policy for citizens in opposition to the rest of the continent. The UK Prime Minister Boris Johnson, as usual, was clear making this statement on Italian measures: "Our country is a freedom-loving country (…) If we look at the history of this country over the past three hundred years, virtually every advance, from free speech to democracy, has come from this country (…) It is very difficult to ask the British population uniformly to obey guidelines in the way that is necessary". This statement provoked a straight answer of the President of Italy, formally the most important political office in the country: "We Italians also love freedom, but we also care about reliability" (Heffer 2020).

Although the political debate is not the focus of this article, it is clearly interesting for several reasons, mainly because of the impact of pandemic-related freedom restrictions and different health measures in diverse political frameworks. If, at certain times, the two countries have taken almost identical measures (see Table 1) – i.e. measures affecting people's daily lives in the same way and thus social representations and political debate – it is evident that the scientific community (the focus of this paper) has faced different scenarios: in Italy, basically, it has been in favour of government-approved restrictions, whereas in the UK scientists have often been against their government's perceived inaction. In the considered period, in Italy scientists have been in the mainstream, not always in the UK.

2.4 The role of the expert systems: between trust and reflexivity

A comparative approach can be functional to understand whether there is a common position of scientists or different political context and cultures are determining factors that explain the behaviour of science.

First of all, it should be remembered that medical knowledge, in contrast to political discourse, can be defined sociologically as a knowledge of experts. One of the characteristics of modern society (post-modern or radical modernity or liquid modernity), as interpreted by critical authors such as Bauman, Beck and Giddens, is to construct symbolic emblems (key symbols) and expert systems, which are abstract. Such systems are those sets of technical, specialised knowledge that constitute the heritage of experts, but which are also the prerequisite for most of the everyday actions. Social actors routinely use sophisticated technologies, taking it for granted (trusting) that they are effective and safe (smartphones, electrical appliances, airplanes, etc.): if only those who possess all the knowledge about vehicles, routes, crews could travel by plane, a few would fly; this, according to Giddens, is one of the characteristics of radical modernity, because in the past travellers and experts basically coincided. However, 'abstract systems' provide contemporary citizens with much greater

margins of safety than existed a few centuries ago, expanding space-time distances. Symbolic emblems and expert systems enucleate social relations from contextual constraints, but both of these mechanisms rest on the notion of trust, which is accorded more to abstract competences than to individuals in general (Giddens 1990): "Trust may be defined as confidence in the reliability of a person or system, regarding a given set of outcomes or events, where that confidence expresses a faith in the probity or love of another, or in the correctness of abstract principles (technical knowledge)" (ibid: 34).

The importance of trust is indicated by another classic author of sociology, Luhmann (2017), who explains that it constitutes a process of complexity reduction: "Without trust he/she (social actor) could not even get out of bed every morning". He/she would probably be assailed by an indeterminate fear and a paralysing panic. "No individual is able to withstand such a direct confrontation with the extreme complexity of the world". The evolution of expert systems, abstract by nature, however, is such that: "In the conditions of modernity, more and more people live in circumstances in which the primary aspects of everyday life are organised by disaggregated institutions that link local practices with globalised social relations" (ibid: 85). It emerges the centrality assumed by representatives of abstract systems, the so-called access nodes to expert system, which are contact nodes between laypersons and the 'esoteric knowledge' of an expert system: "Confidence is needed because there is a fundamental ignorance of the social world" (ibid.: 94).

Permanence of trust in abstract systems depends on the conduct of systems' representatives (access nodes). This last consideration, drawn from the thought of Giddens, should be useful to understand how a scientist who decide to get involved by opening a profile on social media take on a strong responsibility, connecting their own expertise ('esoteric knowledge') with laypersons. And it should also be useful to understand that is not a matter of analysing a simple communicative process but of investigating one of the fundamental aspects of modernity: one of the essential traits that appears in social networks, in a very substantial proportion of people commenting on experts' posts, is the total absence of trust. We will try to describe the characteristics of these (legitimate?) doubts, but it is important to remember it is not a marginal issue but one of the pivotal symbolic systems constitutive of modern society. Indeed, one of the characteristics of modernity is reflexivity. "The reflexivity in modern social life consists in the fact that social practices are constantly examined and reformed in the light of incoming information about those very practices" (Giddens 1990: 46) thus substantially altering their character – a revision of beliefs involving all aspects of human life (modernity is marked by a hunger for novelty).

Picking up on what was said above on the precariousness of scientific knowledge, one should remember that the reflexivity of modernity subverts the reason, at least if one interprets reason as the acquisition of stable and definitive knowledge: "We live in a world entirely constructed by reflexively applied knowledge, but at the same time we can never be sure that any element of this knowledge will not be called into question (...). There is nothing certain in science and nothing can be proven even if the surest information about the world to which we can aspire is the result of scientific endeavour" (ibid: 47).

Situation becomes even more difficult for lay knowledge in the face of certain drifts of modernity, those risks of which Beck speaks. The society of globalised risks (Beck 1992) is confronted with crises of a global nature transcending the boundaries of nation states and, by putting them in crisis, create distrust in expert systems. Among the many risks that Beck mentioned thirty years ago were also major epidemics, at that time just considered one of the hypotheses in the field but now become reality. This set of essential risks undermine layperson's faith in expert systems (eroding what Beck calls the sense of 'ontological security', the deepest and most essential level of existential security). Trust in expert systems is undermined by the expert systems themselves when spaces of doubt open up due to new knowledge. In fact, it becomes clear that we live with dangers that are beyond individual and collective control: are high-intensity dangers that threaten the lives of

millions of human beings and, potentially, of all humans. These are not dangers that everyone chooses to run: there are no 'others' to be held responsible, attacked or criticised.

2.5 Experts on the battleground

Essentially, scientists who play an information role not only aim to gain the public's trust, but they also represent a model of knowledge that requires some level of 'fideist' surrender. Think about the vaccine issue: it works just because healthy people, with no symptoms of any disease, have to take a 'drug'. Considering nature and etymology of the Greek word 'medicine', one must emphasise that it represents both a remedy (medicine) and a danger (poison). Even if 'adverse effects', allergic reactions and other problems associated with taking vaccines were not known in antiquity, today those who vaccinate basically accept to trust (an act that is not immediately rational) a knowledge about which they understand almost nothing (expert knowledge, symbolic emblem). If in a society the level of trust in authorities (political or health) is not high or is not fully shared, it may happen that expert knowledge is not sufficient, and is not the object of a necessary trust, as when one gets on an airplane without knowing exactly the laws of physics.

In the first place, therefore, public opinion has been induced to take for granted at least two questionable assumptions: (i) there is an undisputed objectivity of research data (scientific, as hard science); (ii) political decisions are substantially 'consequent' (there is nothing else to do but "follow the Science"). However, divergent decisions taken by governments have challenged these assumptions: in this sense, the Italian and UK cases can be interpreted as opposite poles of a continuum from total closure (*lockdown*) to totally opening, making clear that, starting from the same (objective) data, it is possible to choose different public health courses.

The theoretical context is therefore connected to the relations between expert systems (and abstract systems) and public opinion analysed by Giddens and Beck in the recent past. It should be noted, above all, that Beck's approach (1992) still appears of striking interest, when it describes how, supposed, scientists' hard knowledge is questioned during serious globalized crises, such as epidemics and pandemics.

3. Methodology

This contribution starts from the analysis of some social profiles (Twitter) focused on scientific dissemination on Covid-19. Therefore, considering the plurality and complexity of that debate (Gobo and Sena 2020; Gesser-Edelsburg et al. 2021), arguments that refer to irrational or emotional spheres (conspiracies) or profiles of public figures other than medical doctors, scientists and scientific communicators have not been directly discussed, taking instead into consideration interactions between scientific social profiles and their followers.

In details, a web-ethnography was carried out in autumn-winter 2021, based on the analysis of some social profiles of well-known medical doctors, scientists and scientific communicators.

Using the *Foller.me* app, Twitter profiles with a significant number of topics, hashtags and mentions consistent with certain keywords (e.g. SSN – the Italian national health service, NHS – the UK one, no-vax, Covid-19, vaccines, pandemic, Science) were selected: in particular, profiles of medical doctors, scientists and scientific communicators that produced a significant number of tweets mentioned by other medical-scientific profiles. *Foller.me* is a *Twitter Analytics* application that offers insights about any public Twitter profile, gathering near real-time data about topics, mentions, hashtags, followers, location and other information.

An analysis of 10 Twitter profiles (5 males, 4 females and a group), chosen among the most popular and active scientific Italian and UK profiles) was linked to a scrutiny of a selection of speeches and interactions generated around them. A qualitative content analysis was realized to comprehend manifest meanings but also latent interpretations about the aforementioned issues (Mayring 2004; Strauss and Corbin 1990).

In the Italian context, chosen profiles were:

- Nino Cartabellotta (@Cartabellotta) - Medical doctor, MD, president of the Evidence-based Medicine Italian Group, GIMBE Foundation (70,626 Twitter followers);
- Maurizio Scaltriti (@ScaltritiLab) - PhD, formerly professor at Memorial Sloan Kettering Cancer Center of New York and Vice President of Translational Medicine in the Department of Oncology at AstraZeneca (18,998 Twitter followers);
- Aureliano Stingi (@AurelianoStingi) - PhD in Cancer Biology, consultant to the World Health Organisation and contributor to the Italian newspaper La Repubblica (21,590 Twitter followers);
- Irene Tosetti (@itosettiMD_MBA) - Anaesthetist MD, Consultant, HUG University Hospital of Geneva (18,620 Twitter followers);
- Roberta Villa (@RobiVil) - Health writer and journalist, editor-in-chief of the Italian magazine *Un Pediatra Per Amico* (A Paediatrician as a Friend), UPPA (24,948 Twitter followers).

In the UK context, chosen profiles were:

- John Burn-Murdoch (@jburnmurdoch) - Financial Times journalist and visiting senior fellow at the London School of Economics and Political Science, LSE (448,175 Twitter followers);
- Deepti Guardasani (@dgurdasani1) - Clinical epidemiologist and statistical geneticist, senior lecturer in machine learning at the Queen Mary University of London (138,414 Twitter followers);
- Independent SAGE (@independentsage) - Group of scientists working together to provide independent scientific advice to the UK government and public on how to minimise deaths and support Britain's recovery from the Covid-19 crisis, chair is Deenan Pillay, Professor of Virology, UCL Pro-Vice-Provost International, University College London (180,691 Twitter followers);
- Meaghan Kall (@kallmemeg) - Epidemiologist at the UK Health Security Agency, in 2021 the journal Nature named her in Nature's 10, their global top ten list of people who helped shape science that year (59,759 Twitter followers);
- Michael Makris (@profmakris) - Professor of Haemostasis and Thrombosis at the University of Sheffield (11,611 Twitter followers).

For each of the chosen profiles, the ten tweets that generated the most reactions from Twitter users - along with the reactions provoked - were analysed; the period considered (two months) was that between Nov 1st and Dec 31th 2021, a phase characterised, both in Italy and in the UK, by a progressive increase in infections (see Table 1) and by a heated public debate on the most useful public health measures for the management and containment of the Covid-19 pandemic.

4. Emerging profiles

In the varied panorama described above, there are some prevalent arguments that constitute the basis for identifying and distinguishing different typological profiles. In other words, it is a phenomenology of prevailing attitudes, which does not claim to be exhaustive, but which can be useful on a heuristic level to distinguish the plural and different characters that debate has assumed in recent times. Such a phenomenology

is certainly not exhaustive but seems to have reached a high level of semantic saturation (Bichi 2000; Spinelli and Volterrani 2011). Further sessions of texts analysis, in fact, did not reveal, at this stage, any other profiles that can in some way be united in a taxonomy, even provisional and approximate. However, it seems that the following may represent an effective synthesis of what emerges in the considered time span (Nov 1st and Dec 31th 2021).

1. *Reliability of sources and competence*: it refers to the scientific nature of information. "It is said by the World Health Organisation (WHO)", "it is written in the report of the Italian National Institute of Health (ISS)", to which other sources can be added, such as the Centers for Disease Control and Prevention (CDC), the European Centre for Disease Prevention and Control (ECDC), the Imperial College London, the London School of Economics and Political Science, the Italian Medicines Agency (AIFA) and the European Medicines Agency (EMA), the Italian National Institute of Statistic (ISTAT), or non-institutional sources such as GIMBE Foundation, the Institute for International Policy Studies (ISPI) and Independent Sage.

This position is in direct opposition to those who, on the no-vax front, provide data from uncertain, unreliable or completely falsified sources (*fake news*). It should be noted that it is not a matter of imposing the principle of authority (*ipse dixit*) but to justify claims according to reliable scientific data.

Reliability of sources and competence position emphasises a certain level of trust, often critical, in public institutions. Contrary to no-vax positions, doubtful of both private (e.g. pharmaceutical companies) and public (health institutions) sources, these arguments emphasise the neutrality of regulatory authorities (such as EMA) and institutions as a whole. It should be noted that a part of this argumentation, which is not prevalent but certainly present, sometimes seems to lead to a form of scientistic snobbery that fuels controversies: in some cases, the idea that "data are self-evident" prevails, as if there was no need for interpretation and it was even superfluous to explain one's positions.

In an ideal continuum, the reading of authoritative sources is accompanied by the principle of competence, especially in the scientific sphere: "no-vaxxers do not know what they are talking about"; "it is ignorance". Such statements refer to the need not only to indicate a source but also to be able to interpret it properly. According to such an interpretation, with specific reference to Italy, it would be manifested one of the most general characteristics of Italian society, i.e. the problematic relationship with STEM disciplines (science, technology, engineering and mathematics) and the unfamiliarity with them of a predominantly humanistic culture. This is of course a simplification, but reinforced by reading some posts from eminent philosophers or political representatives characterised by errors concerning basic arithmetic operations.

Overall, this profile appeared, and appears, particularly homogeneous in the two countries, echoing a stark view, widely present within the international scientific community, of the opposition between expert and lay knowledge.

2. *Epidemiological nationalism*: although it is not often emphasised, one of the features of the pandemic in the international debate is a peculiar nationalistic posture in which the positions taken by different governments are assimilated into the national culture. The so-called Swedish and UK models, in short, are understood as a link between political decision-making and national culture. The argument, exposed in almost enthusiastic terms, sounds like this: "Italy is doing better than other nations".

Although this is an obvious simplification, it is equally clear that in the pre-political debate on social media (but also on TV talks) such discourse enjoys considerable legitimacy, suggesting that Italy, despite having suffered an impressive wave of infections in the winter 2020, has responded adequately and even better than

other countries: a position particularly unwelcome to those profiles opposing the current government majority in Italy (summer 2022).

In the UK, the perspective is different as, on a general level, since the beginning of the Covid-19 pandemic the scientific community - certainly with regard to the profiles considered in this study - has been critical of the measures taken by London government, considered too mild. Commenting on an article appeared in *The Telegraph* on 20 December 2021 ("Ministers stand their ground against the scientists in lengthy battle over Christmas Covid restrictions"), Deepti Guardasani argues: "When you're battling with scientists in the midst of a crisis in a pandemic, public health has already lost. This framing by media of 'ministers standing their ground' against scientists like this is the brave thing to do - when it'll certainly lead to loss of life - is terrifying". A tweet, this one, that generated a number of responses in support of the scholar's position, but also some distinctions: "Cancelling Christmas will also lead to a certain loss of life though businesses on the edge, people suffering so much with mental health from this. You can't just look at this from one side".

Thus, *epidemiological nationalism* took the form of an alliance between most scientists and policymakers in Italy (with some exceptions in opposition parties and clearly in public opinion) and represented an occasion for confrontation between government and experts in the UK, both committed to winning public support for their respective positions.

3. *Realism*: argument represented by those who do not provide a prejudicial interpretation of the measures taken by the government, underlining the fact that in a situation of risk and uncertainty the containment measures were probably inevitable.

In Italy, this profile concerns people not enthusiastic about Italian government but who recognise its merits, and those who, above all, oppose the so-called 'optimists'. The latter can be identified in a specific social media group (*Pillole di ottimismo*) that also gathered relevant figures from the scientific world who, since May 2020, had started to propose a narrative opposed to the attitude of fear diffused in the country. Controversies on social media polarised positions: firstly, optimists were identified with those who, since May 2020, repeatedly claimed that the pandemic was over. Optimists were then assimilated with negationists by the more 'realistic' front, which argued that they should have stuck to the data and refrain as much as possible from making predictions. Realists, however, were in turn accused of being pessimists, of "enjoying the lockdown" and of wanting to "lock everyone in".

Of interest is the fact that conflicts arose above all over forecasting models: SarsCov2 has called into question certainties that science had consolidated over time (e.g. herd immunity, contagiousness limited to symptomatic individuals, seasonality of a "simple flu virus"). Therefore, each prediction triggers controversy and a flurry of comments with contrasting data: hence the practice of keeping the posts of opposing faction and re-posting them every time a prediction is proved wrong ("Shouldn't the pandemic have ended?"; "Shouldn't we all have died?").

From this point of view, there are no striking differences between the two countries, as evidenced by the reactions to the tweets with which John Burn-Murdoch tried to propose a reasoned reading of pandemic data in the UK. A follower critically pointed out: "So many people seem desperate to make the pandemic fit their political prejudices. I hope they notice that it refuses to do so". Another, sibilantly: "If only one of the *Big Pharma* companies could find an easy to take pill just in time for this worrying rise...".

What differentiates the two countries in this case is the fact that Italian *realists* - during the observation period - were usually identified with pro-government (or at least non-critical) positions towards the action put in place by policymakers to contain the spread of virus; in the UK, the less linear attitude of the leadership made the positions of *realists* difficult to place as critical or acquiescent with respect to Downing Street political choices.

4. *Moralism, anger and concern*: even apparently neutral ('scientific') arguments may lead to fierce confrontations in the context of social media. Although there is no single profile to describe the no-vax universe, and although the debate on vaccine hesitancy is complex (Graffigna et al. 2020; Barello et al. 2021), there is a tendency to consider this front as essentially irredeemable, and this generates angry reactions exacerbating conflicts. An example is the accusation that those who do not vaccinate are profiteers: here the economic category of free-riders is used - i.e. those who benefit from the sacrifice of others, who enjoy the reduction of restrictions due to the vaccine, but who risk little or nothing by not taking vaccines or by waiting for others to do so before they do.

During the observation period, in Italy, anger was particularly triggered by arguments that expressed the frustration of those categories most sacrificed and affected in their way of life in the early stages of the pandemic (young people) and of those that perceived as thwarted part of the efforts sustained and risks taken (health and medical professions): "Because of no-vaxxers ... you cannot treat cancer patients, you cannot enjoy leisure activities or entertainment, you cannot return to normal life".

In the UK, there was a feeling of concern that seemed to prevail in autumn-winter 2021, with specific reference to children's health. In Independent Sage's profile appears the tweet "We're not sending our children in to schools to drink poisoned water. So why should we be sending them into schools to breathe poisoned air?", generating fierce controversy among followers about the costs and benefits of vaccinating children and whether schools should be kept open regardless of the severity of epidemiological situation.

Moralism, anger and concern appeared from the outset to be general and salient features in the Italian debate on Covid-19, reaching its peak during the vaccine debate to counter and condemn vaccine hesitancy and refusal. In the UK, these elements of harshness and recrimination, certainly present, emerged intermittently in different ways and degrees, depending on the specific issues from time to time at the centre of public attention.

5. Final considerations

While being fully aware of the limitations of this article - arbitrariness in choosing to compare two specific national contexts and not others, to focus on a social media with peculiar characteristics (Twitter) and to consider a limited number of profiles deemed particularly significant - the authors believe that some interesting suggestions emerge.

One of the insights that moved the authors was the observation of poor reflection on pro-vax positions: even if we accept the hypothesis that these are hegemonic positions, and therefore mainstream (i.e. dominant in public opinion), it is clear that they cannot be all aligned with the image of those who refuse any dialogue and insist on simplistic slogans. Pro-vax world is therefore also complex and articulated, varied and full of distinctions. For this reason, it was decided to study this composite 'front' of the controversy. Moreover, starting from some fundamental theoretical assumptions such as those that recognise the importance of rhetoric in scientific discourse, it was decided to consider scientific arguments because of the fact that sceptical (but also negationist, minimising or doubtful) positions also contain arguments about the construction, use and interpretation of scientific data (Giorello 1985).

In other words, if a substantial part of pro-vax front is made up of those who are in favour of vaccines and containment measures based on the analysis and interpretation of epidemiological data, there are also positions which, although not necessarily no-vax, consider preferable a strategy which can be defined as *laissez-faire*,

in analogy with the liberalist approach in economics. These are generally scholars, but not only, who, believing that economic interests prevail, advocate a strategy of freedom without restrictions, unless very limited [1]. Again, these positions refer to a certain interpretation of the pandemic data, but generally do not come from the medical world [2]. The idea is to protect the most fragile people - usually the elderly and those who are already sick - letting the epidemic to 'run its course' until achieving herd immunity. Again, recently, supporters of this view have been stressed the importance of infecting children with the aim of obtaining immunity. A position that many see reflected in the UK Government's strategy, both in the early stages of the pandemic as well as more recently. This distinction in the pro-vax world is to be considered as a first research result.

Furthermore, the analysis of empirical data in this study may provide useful insights into rethinking public discourse around vaccines and infection control measures. Firstly, it seems increasingly misleading to define the political space with pro-vax and no-vax dichotomies. Apart from some pre-political positions (conspiracy), there has been a lack of reflection on the contextual and non-neutral nature of medical knowledge and the 'medical-industrial complex' (Relman 1980). Considering that *Big Pharma* (Blaskiewicz 2013) cannot be described as a disinterested actor, when pro-vax discourse entered the controversy, arguments proposed on such a critical issue often failed to be particularly convincing. Moreover, even the use of data, as self-evidence, shows how scientific discourse is not always able to consider the hesitancy of a part of public opinion. In fact, from the analysis of the profiles we took into consideration, it oftentimes emerges the negation of any form of dialectical confrontation with those who have different positions. That contradicts openness and transparency that should characterize scientific debate, even in an emergency context. A central theme, the latter, which opens a critical reflection on the issues of public communication, informed participation and manifestation of dissent in Western democracies.

Finally, let's consider scientific knowledge as knowledge in the making, contextual, critical: the nature of some pro-vax positions seems to take for granted that no doubts should be raised in the name of emergency. Even the action driven by good intentions and meritorious of scientific dissemination (sometimes left to the goodwill of individuals) seems to be inspired by the (paternalistic) prejudice of fear or lack of knowledge (scientific literacy) and not by the (uncertain) nature of the knowledge process. Hence, because of the poor nature of the public debate, a simplification of argumentations (pro-vax vs no-vax) seems to be emerging, with the consequence of further polarising positions and not to discuss the issues on which scientific knowledge still has a long way to go. Such an approach, focusing on what people do not understand, neglects why what they think might make sense, as part of their everyday lives, experiences and values, and misses the opportunity to identify how people frame an issue and which factors shape their perplexities and anxieties about it: many controversies over public issues involving science seem to overlook these aspects and are indeed framed in terms of (mis)understanding or lack of understanding of science or associated risks. This lack, however, may be not just of knowledge, but of trust in science itself and in its governance, and, when the emphasis is on the negative by the public – deficits of knowledge, of rationality, of trust – scientific institutions are called to respond by winning hearts and minds (Fairhead and Leach 2012).

Therefore, interesting lines of future research appear to emerge, adopting, for instance, the *Science and Technology Studies* (STS) approach, according to which scientific production in the post-truth era should be also understood in negotiating and hermeneutic terms, overcoming not only the dichotomy between true and false but also between expert and lay, in order to focus on the social processes through which knowledge and supporting social groups are legitimized, or not, in different social arenas (Collins and Evans 2002).

[1] In Italy, one of the best known in this context is Riccardo Puglisi, economist at the University of Pavia.

2 The most distinguished position is represented by the scholars gathered around the so-called Great Barrington Declaration (GBD) of 4 October 2020.

Table 1 - Italy vs UK: timing of health measures and political decisions (2020-2022)

Time	*Italy*	*United Kingdom*
January, 2020	'State of emergency'. Measures for travellers (quarantine) form abroad.	
From February, 2020	The so-called 'lockdown' (starting form some northern areas, gradually extended nationwide): "Stay at home".	Measures for travellers (quarantine) from abroad. The line is: "no lockdowns in UK".
March, 2020		"UK government doesn't follow the Italian measures". "Herd immunity strategy" (conflict with several scientists on that). Social life continues as usual (cultural and sport mass events).
End of March to mid-April, 2020		First national lockdown. The PM, Boris Johnson, contracts Covid-19.
From mid-April, 2020		Lifting of the lockdown (starting in May in Wales) based on the epidemic/Health system conditions.
From May to June, 2020	"Phase 2", gradual loosening of previous containment measures.	
June, 2020	"Phase 3": the "coexistence" with the virus.	
July, 2020		Some measures reintroduced due the rise of new virus cases.
September, 2020		Social gathering is newly banned.
October, 2020	New restrictions (the so-called "second wave").	About a quarter of population is in lockdown. A new approach based on local situation. New lockdown in Northern Ireland, Wales and Scotland.
November, 2020	A new scenario: coloured zones (night curfew and local restrictions according to prevalence, number of cases and hospital situation). Different areas (Regions) implement different measures (relaxation or restrictions).	New national lockdown.
December, 2020	New restriction for Christmas holydays.	A scheduled relaxation period for Christmas is cancelled. The lockdown continues nationwide. Starting of the vaccination campaign.
January, 2021	Starting of the vaccination campaign.	
February, 2021	A new government, headed by the former European Central Bank (ECB) President, Mario Draghi, comes into office.	Relaxation of the restrictions.

March - April, 2021	New Restriction (in Easter holydays, no inter-regional transfer permitted for a week).	
Mid April, 2021	First measures for loosening restriction (i.e. schools re-opening); *Green Pass*: freedom of movements depends on the vaccination status or negative test.	
May – June, 2021	Gradual re-opening for several working and social activities.	
July, 2021		Lifting of all the restrictions nationwide. Face masks are recommended (not mandatory) in gathering.
From August to December, 2021	Implementation of the *Green Pass* - vaccine certificate or test mandatory for some workers (in health sector, school, university, etc.) or to use public transports.	
December, 2021	New wave of the contagion. Social activities are basically banned. *Green Pass* needed for further working activities.	Face masks mandatory in some settings due to the spread of a new variant of the virus (Omicron). Wales, Northern Ireland and Scotland introduce some measures (social distancing in several social settings).
January, 2022	Vaccination is mandatory for people over 50 years.	
February, 2022		The UK 'Living with COVID' plan (no further restrictions but protection for vulnerable people).
March, 2022	End of the 'state of emergency'.	
April, 2022	The restrictions measures are gradually relaxed. Until May some measures remain (masks mandatory in closed or crowded situations and *Green Pass* for public transports).	

Source: Reconstruction of events realized by the authors and based on magazines, newspapers, websites and other sources.

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