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Poetics

journal homepage: www.elsevier.com/locate/poetic

Mapping epistemic pluralism: A network analysis of discursive practices in communities promoting refused knowledge about healthcare and wellbeing

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ARTICLE INFO

Keywords:

Refused knowledge
Science & Technology Studies
Actor-network theory
Social network analysis
Two-mode networks
Community detection
Multiple correspondence analysis

ABSTRACT

This article presents an analysis of discourses performed in communities that share and disseminate knowledge refused by institutional science. The study focuses on an online community concerned with alkaline water, food, and lifestyle, aiming at understanding how promoters of refused knowledge in this community enrol other forms of knowledge, including science. Theoretically, this work is framed in Science & Technology Studies, and in the tradition of actor-network theory, situating itself in a recent turn that takes epistemic instability and pluralism into due consideration, thus overcoming opaque views of the opposition between science and non-science. Empirically, this fine-grained analytic purpose is addressed by a mixed-method strategy in which discursive practices are observed through a web-ethnography conducted between January 2020 and December 2021 on the relevant online spaces and then analysed qualitatively and quantitatively by means of formal techniques. Relying on the tools of social network analysis, the discursive space of the community under study is formalised as a two-mode network of knowledge claims and heterogeneous actors enrolled in discourse to sustain those claims. Then, community detection is performed to map the different assemblages of claims and actors and the relevant repertoires characterising those assemblages. Finally, multiple correspondence analysis applied to two-mode networks is used to highlight the dimensions of concern and meaning expressed in the knowledge organisation of this community.

1. Introduction

In the social sciences, the debate regarding the way different groups of concerned actors or stakeholders pose challenges to the epistemic authority of science has come to a turning point. In the last decades, authors discussed trends and modes of such contestation of science, differently labelled as *post-truth* (Davis, 2017; Fuller, 2018; McIntyre, 2018; Ylä-Anttila, 2018), *epistemological populism* (Saurette & Gunster, 2011), *pseudoscience* and *science denialism* (Hansson, 2017), *science-related populism* (Mede & Schäfer, 2020), or the *crisis of expertise* (Eyal, 2019), which were also an expression of a general epistemic crisis of Western societies. These modes of contesting science and the relevant cognitive, cultural and socio-political landscapes are, however, far from being homogeneous or monolithic. Recently, increasing attention has ongoingly been paid to the complexities lying beyond those labels, with a deeper understanding of the social processes driving these forms of engaging science (Harambam & Aupers, 2015; Neresini et al., 2024; Prasad,

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<https://doi.org/10.1016/j.poetic.2024.101929>

Received 31 January 2024; Received in revised form 27 July 2024; Accepted 3 September 2024

Available online 21 October 2024

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2022; Tipaldo, Crabu & Moiso, 2023).

These more recent approaches do not conceptualise the disputes over the credibility and validity of truth as a dualism regarding those who hold or do not hold the power of defining truth, as occurs with populism (e.g. Mede & Schäfer, 2020), nor do they deal with the demarcation between science and non-science, which is itself to be problematised (Crabu, Picardi & Turrini, 2023; Gieryn, 1999; Harambam, 2020). Rather, these approaches are concerned with understanding what happens within those communities where science is contested, also considering the current situation of *epistemic instability* by which it is no longer plausible to think of single-sided epistemic authorities guaranteeing truth (Harambam, 2020; Tipaldo et al., 2023). In addition, the alleged irrationality of every form of contestation of science has been criticised, as is the case with *conspiracy theories* (Harambam & Aupers, 2015, 2017). In this respect, Harambam and Aupers (2017) point out how conspiracy theory is internally varied, in contrast with a view of it as pertaining to an undifferentiated collective (see Cafiero, Guille-Escuret & Ward, 2021).

In this paper, we pursue this line of enquiry by following recent work on how those communities which share forms of knowledge refused by institutional science try to (re)position the latter in order to legitimate their knowledge claims (Picardi, Serafini & Serino, 2024). At the same time, we focus on how “groups of people assign credibility and trust to knowledge claims located outside the established boundaries of science” (Crabu et al., 2024, pp. 1-2). To this end, we propose a mapping of discursive practices obtained by combining web-ethnographic and network-analytic techniques in a study concerned with these communities.

This work situates itself in the tradition of Science & Technology Studies (STS), whose scholars have highlighted how contestation and distrust of science may be related to complex social processes and have not to be merely dismissed as anti-scientific or anti-intellectual forms of conduct or attitude (e.g. Lynch, 2017, 2020; Prasad, 2022). Adopting a ‘symmetric’ perspective, as it has recently been reconsidered in STS (e.g. Lynch, 2017, 2020; see also Pellizzoni, 2019), the angle from which we look at refused knowledge avoids a normative stance that would grant truth or validity to one knowledge form over another, hence preventing us from dismissing non-official knowledge as mistaken or false (see, for a thorough discussion, Neresini, 2024).

The aims of this study are as follows. First, we intend to investigate how a knowledge form *enrols* other forms of scientific and non-scientific knowledge. Following Latour (1987, 2005), by *enrollment* we mean the discursive involvement of various human and non-human actors that can be concerned with or interested in the matter (see also Callon & Law, 1982). That scientific knowledge is mobilised to support claims that result even adversarial to science is not new, although it has become more noticeable during the COVID-19 pandemic (Prasad, 2022). The present work tries to provide substantial evidence of this mobilisation by highlighting how it results in differential patterning of discourse within communities contesting institutional science.

Second, the present analyses are focused on the relational structures observed within discourses performed in what we call *refused knowledge communities* (RKC; see Neresini, 2024; Picardi et al., 2024; also Bory et al., 2023). Specifically, we consider the narratives constructed in these communities to analyse the relationships between different claims of refused knowledge and the actors discursively enrolled to support these claims. Our work thus focuses on the *associations* (Latour, 2005) made between claims and actors through discourse; more precisely, we study the associations discursively built into narrative structures which convey ideas about culture, practices, values, etc., that sustain specific kinds of conduct and attitude towards the ‘fabrication’ of facts. Conceptually, the present study is partly rooted in actor-network theory (ANT; Callon, 1984; Latour, 2005). Empirically, we investigate these associations by the tools of social network analysis (SNA; Scott, 2000), formalising the connections between claims and actors through two-mode networks, which can be used to analyse discursive frames (Vedres, 2022). Hence, we both operationalise these linkages by taking heterogeneous actors into account (Mützel, 2009) and leverage Breiger’s *duality* principle (Breiger, 1974), in that two knowledge claims are linked insofar as they share the same actors, and vice versa. This attempt also acts as a methodological stance: we deploy the potential of SNA in the field of STS and ANT (Mützel, 2009; see also Cambrosio, Keating & Mogoutov, 2004; Callon, 2006) and in the so-called *sociology of associations* (Latour, 2005).

Third, the repertoires constituting the discursive spaces of refused knowledge are a key object of this study. Previous work (Picardi et al., 2024) has found how this refused knowledge is structured through an assemblage of other forms of knowledge, creating an ecosystem in which science and non-science coexist. Indeed, Picardi et al. (2024, p. 164) have highlighted the “hybrid nature of the RKC epistemic enrolment space”. Building on the latter study, the current paper explores the heterogeneity of the narrative repertoires to which knowledge claims pertain, to identify the patterns of relationships through which these repertoires are combined with one another. To this aim, community detection is performed, showing the patterns of association characterising these assemblages.

Finally, in order to unveil relevant dimensions of concern and meaning in the association between knowledge claims and actors, multiple correspondence analysis (MCA) is applied to the two-mode network data (D’Esposito, De Stefano & Ragozini, 2014; Serino, D’Ambrosio & Ragozini, 2017). The outputs of these analyses are maps of refused knowledge that permit assessment of the constitutive arrangement of discourses in the RKC under scrutiny. Specifically, we deal with online communities of groups promoting an alkaline diet (but mostly an alkaline water drinking habit) to counter the risk of different diseases related to metabolic acidosis (see Section 3).

2. Understanding challenges to the epistemic authority of science

The current exposition of scientific knowledge and expertise to social and cultural reconfigurations, in an age of *epistemic pluralism* (Neresini et al., 2024), requires scholars to pay deeper attention to discourses framed in the tensions deriving from the contestation of science. In this respect, we adopt the concept of *refused knowledge* proposed by Neresini et al. (2024) to mean knowledge that scientific institutions do not consider as belonging to the one produced within the epistemic boundaries of ‘official’ science; the communities sharing that knowledge are termed RKC (see above). Far from reproducing a situation where “scientists were the holders of privileged expert knowledge, while the lay public was to be enlightened and educated” (Gibbons et al., 1994, p. 36), refused knowledge is now playing a chief role in shaping the discussion on health outside the borders of scientific communities.

A case in point is the discussion regarding the quest for objectivity in knowledge reputedly distant or opposite to science. Lynch (2020, p. 50) remarked that the claims of alleged anti-science proponents subsumed under the label of *post-truth* should be understood as “adversarial claims to objectivity and institutional supports for those claims” and not merely as “an outright rejection of science and objectivity”. This is key to the present argument, as refused knowledge often turns out to be an attempt to reframe knowledge produced by official institutions. In this sense, Prasad (2022) observed that it is “intellectually lazy to argue that anti-science claims are a result of a rejection of scientific objectivity and value neutrality of science” (Prasad, 2022, p. 92). Instead, the social processes by which refused knowledge is constructed and disseminated need to be deeply understood, avoiding superficial or partial accounts. In the words of Prasad, what matters is how knowledge forms are “discursively framed and interpreted within and by particular social groups” (Prasad, 2022, p. 89).

On the other hand, controversial issues regarding non-stabilized scientific knowledge arise because of the confrontation of diverse views – either amongst scientists, politicians, laypeople, and so forth – in the public sphere (Collins & Pinch, 1993; Neresini & Lorenzet, 2016). Also in this case, caution is needed when dealing with the exacerbation of the debate regarding science, particularly biomedical science. There are heterogeneous communities within which lay experts, professionals of wellbeing, and sometimes scientists as well, try to provide interpretations of (and solutions to) illness and malaise, or explanations of their causes, that appear alternative to those provided by institutional science. Whilst the knowledge claims of these groups can be dismissed as ‘non-scientific’ or ‘pseudoscientific’ by institutional science and the larger public – especially if these representations are vehiculated by the media – the landscape of cultural forms that make those claims embedded in complex worlds of shared meanings and interpretations deserves much effort in social scientific work.

This is why the present work focuses on narratives circulating within groups of people who share concerns in a given area related to health and wellbeing by interacting on social media. This also turned out to be a methodological choice. In the current mediascape, discussions about sensitive, publicly relevant topics often result in the polarisation of opinions, as social media algorithms lead users to interact in echo chambers (Bessi et al., 2016). An ethnographic account of discursive interactions in such a landscape may allow one to go beyond the surface of polarised opinions and unveil a more complex organisation of narratives and meaning-making.

2.1. Ambivalence of discursive spaces in communities promoting knowledge refused by science

Discursive spaces are arenas where statements, narratives and symbols are framed, shared and meshed to vehiculate meaning. As far as controversies in science are concerned, “the creation of a discursive space involving experts, scientists and societal stakeholders is marked by a certain degree of ambivalence. This process is not merely a unidirectional tension or opposition between science and society” (Tibaldi et al., 2023, p. 592). This is inherent to communities promoting knowledge refused by science as they involve a plurality of actors, be they scientists or non-scientists, enrolled to support such refused knowledge. Ambivalence is a central feature of epistemic instability (Harambam, 2020) that marks many disputes over the validity of scientific knowledge. Hence, RKC focused on healthcare and wellbeing are amongst the arenas where scientific knowledge is more central and, at the same time, more subject to different forms of contestation, each having its complexities.

First, such contestation can be the expression of some form of science-related populism, understood as the “antagonism between an (allegedly) virtuous ordinary people and an (allegedly) unvirtuous academic elite” (Mede & Schäfer, 2020, p. 484), although what lies behind this form may well be the quest for a more shared understanding of scientific facts. Anyway, the political polarization of science (Rekker, 2021) is always lurking, as far as it concerns the “intersection between scientific claims, facts, and political beliefs” (Rekker, 2021, p. 355).

Second, the contestation of institutional science can take the form of *science denialism* (Hansson, 2017) which consists of being hostile to some specific account or theory – or of “making a case for alternative *interpretations* of facts, as with climate change denial” (Pellizzoni, 2019, p. 118).¹ This must be distinguished from *pseudotheory promotion*, whose advocates are “driven by their aspirations to advance a theory or a claim of their own. This implies the rejection of some parts of science, but that is not a primary goal for them, only a means to promote their own theory”, as is the case with homoeopathy or iridology (Hansson, 2017, p. 40). Both science denialism and pseudotheory promotion are forms of “doctrinal deviation” of pseudoscience but, interestingly, the elaboration of knowledge in the latter form is what often characterises RKC.

However, how complex the opposition to scientific authority may be is often misrecognized and, when conflicts or competition between different conceptions of scientific knowledge shape a discursive space, the contestation may imply a demarcation between knowledge forms considered reliable or unreliable, which is fundamentally a matter of *boundary work* (Gieryn, 1983). Interestingly, this may be a concern for scientists but also for non-scientists interested in fabricating relevant knowledge claims. The way discursive spaces appear to an external observer is indicative of the extent to which the proponents of refused knowledge present themselves as competent figures. For instance, Harambam and Aupers (2017) show how conspiracy theorists can think of themselves as “critical thinkers” who “reclaim their rationality”. The same applies to the “battle for truth” that some people may engage in through hate speech against the “corrupt elites” (Fangen & Holter, 2020).

The ambivalences and complexities of the discursive spaces of RKC can be understood by focusing on the diverse repertoires at work within them. In particular, what should deserve more attention is the way RKC deal with science and scientific products by enrolling them (Latour, 1987) or by mimicking the related rhetoric, symbols, and practices (Neresini et al., 2024) to frame their claims.

¹ On climate change as an ambiguous event that can lead to denialism see Tavery and Wagner-Pacifi (2022).

In addition, other forms of narrative that are present in this space should also be considered. Since such repertoires are often intertwined, the analysis has to disentangle the assemblages that result from their combination.

2.2. Networks from discourse: an analytical strategy

This section provides a brief discussion of the theory-method background with which the present work is concerned, while the following sections will be devoted to more technical details of the analytical strategy followed. To begin with, it is worth recalling that more than thirty years ago network scholars “turned their attention away from the more objectivist vision of social network analysis (as being all about empirically observable material relations) to embrace a new kind of relational sociology that treats the study of meaning” (Kirchner & Mohr, 2010, p. 556). This kind of relational sociology informs the present study, as we attempt to unveil meaningful relationships between knowledge claims and other discursive elements.

As regards the theory-method nexus, mixing qualitative and quantitative analysis in network research is proper to relational sociology (Crossley, 2010; Emirbayer, 1997; Fuhse & Mützel, 2011) and is chiefly important for research on shared knowledge, where discourse analysis can benefit from relational analyses of meaning structures (Kirchner & Mohr, 2010). It is the co-constitution of networks and meanings that lies at the core of this line of thought (Mützel, 2009). Actor-network theory (ANT; Latour, 2005) is notably a research strand well-equipped for the study of networks and meanings. This theory-method strand mostly relies on qualitative tracing and analysis of networks (Fuhse & Mützel, 2011, pp. 1073–1074) but also employs formal analyses, as occurs also in relational sociology (Mützel, 2009). There are, indeed, remarkable attempts, either recent or dated, at pursuing a “conflation” between different notions of ‘network’ (see Venturini, Munk & Jacomy, 2019) which combine ANT and formal analyses of texts, yielding heterogeneous networks made of publications, substances, concepts, scientists, institutions, etc. (e.g. Callon, 2006; Cambrosio et al., 2004; Hellsten, Opthof & Leydesdorff, 2020).

In this spirit, studies that focus on communication in social media to map discussions in these environments and translate them into network form are noteworthy. For instance, Hellsten et al. (2019) employ both manual coding of users and automated network analysis of message content to map “issue arenas” on Twitter considering both active and passive stakeholders, the former being authors and the latter being addressees of messages (i.e. passive stakeholders are mentioned in discussions but not participate in them, as is the case with the present analysis, see below).

Relying on both ANT and SNA, the current work attempts to frame the analysis of RKC in the above tradition, combining different approaches to gathering data and interpreting results from a quantitative and qualitative angle. In particular, this paper deals with a way of analysing meaning structures (Mohr, 1998) in the discourses observed online, by means of both qualitative content analysis and formal relational analysis – that is, via the tools of SNA and multidimensional data analysis (see D’Esposito et al., 2014).

Indeed, this work is intended to deploy the potential of two-mode networks for the study of structure and culture and particularly the logic inherent to this kind of network referred to as *duality* (Breiger, 1974). This has been proved useful in recent work on cultural sectors like fashion (Godart, 2018) or theatre (Serino et al., 2017), and on cultural tastes (Lizardo, 2024). In addition, specific utility of two-mode networks is found in the study of discourse and the analysis of symbolic regularities, “retaining the duality of symbols (statements) and documents (speech acts)” (Vedres, 2022, p. 6).

In this vein, the present study aims to address the following sets of research questions. First, as we are aware that science is enrolled within RKC’s discursive spaces, and that such enrolment may occur by framing scientific ideas within a politicised narrative, we ask how political discourses are enrolled, and in what ways they combine with other knowledge forms. We also ask, then, whether political discourse is associated with ‘bio-molecular’ discourse and how this association occurs.

Second, as we understand that the different repertoires coexist, what ‘geography’ do they compose in these discursive spaces? And what different instances are expressed in the different groupings of claims?

Third, are there any areas of discourse in which one or more repertoires predominate? If so, what actors of the discursive space are enrolled in those areas?

Fourth, what tendencies are expressed in the knowledge organisation of this RKC? And what dimensions of concern and meaning (and alliances as well) can be highlighted?

We address the first three sets of questions through a visual analysis of the two-mode network representing the RKC under study and by means of community detection. The fourth set is, instead, dealt with by multiple correspondence analysis (MCA) applied to two-mode networks. In each of these analytic sections, we focus on both knowledge claims and actors, though paying chief attention to the former.

3. Method and data

3.1. The case study: the alkaline water community

Discourse pertinent to the RKC under investigation in this work revolves around the idea that alkaline water and food are allegedly beneficial to health and even that their intake can contribute to preventing and treating various diseases (including cardiovascular problems, hypertension, diabetes, digestive disorders, etc., and even cancer). Such alleged benefits, however, did not find support by scientific evidence (see Picardi & Agodi, 2021).

According to its proponents, this knowledge is, instead, sustained by scientific evidence, and the narratives in the alkaline RKC tend to enrol ‘marks’ and tropes of scientific discourse. Several scientists working in academic or scientific institutions also participate in the discourses performed in this RKC. In addition, the promoters of alkaline water also foster a wider ‘life choice’ to live healthily by

adopting alkaline eating and drinking habits. In recent years, and particularly during the COVID-19 pandemic, the promotion of an alkaline diet and even of an ‘alkaline lifestyle’ as healthy practices have become increasingly popular in online spaces, to which we devoted our attention.

3.2. Data collection

The present work is based on a mixed-method strategy. First, we conducted a web-ethnography of online spaces (Hine, 2020; Markham, 2016) related to the online community gathered around the theme of alkaline water, food and lifestyle. After scouting websites and social media profiles related to promoters of alkaline water and food, nine *online fields* (Hine, 2020; Marcus, 1995) were finally selected, each of which including various online sources (e.g. Facebook and/or LinkedIn pages, YouTube channels, companies’ websites, etc.) linked to the same person(s) or organisation(s). Then, online activities occurring between January 2020 and December 2021 in these spaces were monitored and, for each online space, all relevant discursive, iconic, and audiovisual material (e.g. Facebook or LinkedIn posts, blog articles, YouTube videos, and so on) were recorded in web-ethnography diaries. From these empirical materials, we extracted information apt to be recorded and encoded as elements of a two-mode network made of claims of refused knowledge and human/non-human actors enrolled in the discourse.² The coding procedure is described as follows.

3.2.1. Coding procedure (content analysis)

The coding process was implemented through two steps. In the first step, we identified the initial claim (or *proto-claim*) that expressed the main *health-related knowledge content* in each observation recorded in the ethnographic diaries. In the second step, we extrapolated the *core* knowledge of each content by identifying the actor (or the group of actors) that had an agency relating to health towards another actor (or group of actors) within the claim. We also selected all the actors enrolled to support each knowledge claim. These actors are not merely ideational units (like concepts) but also human and non-human entities mobilised in discourse. To give an example, a simple claim might be “alkaline water prevents ageing”, and the relevant enrolled actors might be “the elderly” or “free radicals”. Claims and actors are, respectively, operationalised as two distinct node sets (*modes*) of a two-mode network, such that their association – which, in our analytical framework, is interpreted as *enrolment* of the actors in proposing the claim – translates into the connection between nodes belonging to each of the two sets. In line with the symmetric perspective pertaining to STS, we included these heterogeneous actors in a unique node set, where they are all *actants* (Latour, 2005). Another key point is that, by this formalisation, claims turn out to be connected to each other via the actors that jointly sustain them, and vice versa.

3.3. Variables

To classify knowledge claims according to their ‘distance’ from institutional science and the way RKC mobilise science or other knowledge areas in their discourse, two categorical variables have been set. First, we included a variable that formalises the extent to which a claim is accepted or refused by institutional science: a variable named ‘Degree of refusal by science’, with six modalities (1=accepted; 2=partially accepted; 3=controversial; 4=partially refused; 5=refused; 6=irrelevant).³ In this variable, the modality ‘controversial’ stands for a still open scientific debate regarding the truth of a claim; in other words, the knowledge content expressed by the claim is still not ‘stabilised’, i.e. there is no concurring opinion about it amongst the scientists and its validity is still in dispute. The modality ‘irrelevant’ denotes the status of a claim that is ‘ignored’ by institutional science simply because it is not deemed to belong to that domain – i.e. a form of “[i]mplicit rejection [that] operates when rival knowledge claims are ignored by orthodoxy” (Collins & Pinch, 1979, p. 239).

A second variable serves the need to classify the repertoire with which a given claim is concerned. To this aim, we rely on the analysis of the discourses of alkaline communities made by Picardi and Agodi (2021, p. 388). According to these authors, discourse aimed at promoting alkaline water to improve one’s health and well-being may pertain to a *bio-molecular* repertoire, which is “built in the language of chemistry, biology, physiology, and uses references to scientific institutions, scientific publications, doctors”, or to an *eco-systemic and holistic* repertoire, “aimed at restoring a balance with nature. The elements building this repertoire are lifestyle, food practices, physical activity, nature, pollution, stress, drugs, nicotine, alcohol, electromagnetic waves, pesticides, the market, the media”. In this paper, we add to these a ‘political’ repertoire, which denotes the politicisation of a claim aimed at attacking, critiquing or dismantling health-related policies and the politics allegedly impacting individual or collective freedom (often in association with conspiracy theories, see above). Hence, the variable ‘Repertoire’ is coded using three modalities: 1=Bio-molecular; 2=Eco-systemic/holistic; 3=Political.

3.4. Mapping partitions and positions of claims and actors

To provide meaningful maps of the discursive space analysed, we provide a visual analysis of network graphs drawn up via the *Gephi 0.9.7* software, also computing degree and betweenness centralities for two-mode networks (Brandes, 2001; Faust, 1997). Our

² This strategy can be compared to the one adopted by Vedres (2022, p. 2), who builds a “two-mode network of statements connected with speech acts” to reveal frame and positions in discourse.

³ This classification is based on our reading of the relevant scientific literature, including informative material available on the websites of scientific institutions.

use of betweenness centrality is consistent with the nature of the measure, in that it denotes the capability for a node to play a mediating role in the network (Scott, 2000). We employ this index only as regards the claims, assessing to what extent these latter bridge between different concerns or, on the contrary, bond limited areas of interest in terms of healthcare and wellbeing practices.

Then we performed a community detection analysis by means of the Louvain modularity algorithm (Blondel et al., 2008). The modularity of a partition "measures the density of links inside communities as compared to links between communities" (Blondel et al., 2008, p. 2). Therefore, the community structure of the RKC under investigation is represented as a set of densely connected partitions, or modularity classes, such that each class denotes a given assemblage of claims and actors, with a combination of repertoires characterising those assemblages.

Finally, we apply multiple correspondence analysis (MCA) to the two-mode network data (D'Esposito et al., 2014), performed through the software *Spad 5.5*. This technique exploits the structural similarity between a case-by-variable matrix and a two-mode network data array. In the present work, actors and claims are treated as cases and binary variables, respectively: when an actor is enrolled to support a claim, the entry in the actor-by-claim matrix is 1, and 0 otherwise. In addition, categorical attributes of claims are added as illustrative variables in MCA, according to the procedure indicated by D'Esposito et al. (2014); see also Serino et al. (2017). By MCA it is possible to analyse the different patterns of relation between claims and enrolled actors, assessing the degree of structural similarity between the units in both sets through the distances amongst the vectors and the points representing them, respectively.

4. Analysis

4.1. Network composition

The two-mode network of claims and actors is made of 6 connected components, with a total of 192 claims and 1924 actors (the latter's categories are described in Appendix A, see Supplementary materials). Table 1 shows the descriptive statistics of the claims and displays a low variability in how these are refused by science: unsurprisingly, the majority of the claims (almost 84 %) is totally or partially refused by science. More than 40 % of the claims pertain to the bio-molecular repertoire (because they markedly draw on scientific discourse) but, at the same time, such claims mobilise actors expressing concerns (like the elderly). The other two repertoires are also well-represented and refer to relevant areas of interest: 20 % of the claims are politically-oriented, while 36 % of them pertain to the eco-systemic/holistic repertoire, which is central to narratives about wellbeing.

As for the network composition, the graph shown in Fig. 1 includes only the giant component – which encompasses almost the total amount of claims and actors – with node sizes based on betweenness centrality scores and the size of node labels denoting degree centrality score (showing only the first six claims with the highest degree).⁴ Table 2 shows the highest values of betweenness and degree centralities for the claims, by each type of repertoire.

As usual in two-mode networks, the degree centrality of a node denotes how many nodes of the other set it is connected to; hence, claims with a higher degree are connected to a larger number of actors enrolled to sustain them and, conversely, actors that are very central on this measure sustain many claims. For instance, as for the degree centralities, the most central claim is N157 - "Alkaline water prevents tumour formation", which arguably requires RKC members to mobilise many different actors (see Fig. 2), amongst which different ones relate to science (scientists and scientific institutions) or to the consumption of alkaline water, as is the case with the 'ionisers' that make it possible to obtain alkaline water at home (and which is the most central actor as for both betweenness and degree).

The network has a core of highly central nodes that represent the leading claims of the different repertoires (see Fig. 3 and Table 2)⁵; therein, on the upper side of the graph, two close claims pertain to the bio-molecular and eco-systemic/holistic repertoires, respectively (claims N137 and N145), while N182 (bio-molecular repertoire) and N185 (political repertoire) are placed close to each other at the bottom of the graph, as being intertwined in discourse. The following step concerned with community detection will help disentangle the interplay between these different repertoires.

4.2. The community structure of the alkaline RKC's discourse

The community detection procedure yields 29 communities of claims and actors. The analysis here focuses on the communities containing at least 5 claims, paying attention to how the claims are assembled in different communities and to the way these communities rearrange different knowledge forms. Table 3 shows the composition of the communities as ordered by the number of claims in each modularity class. In the following, we provide a commentary regarding the communities whose composition is more salient, also taking into account the betweenness centrality scores of claims and actors and the topology of the network (Fig. 4).

⁴ Descriptive statistics for both centrality indices are shown in Appendix B, Table B1 (see Supplementary material), regarding the whole network and the giant component.

⁵ Among the claims shown in Table 2, only N216 and N217 are, respectively, partially or totally accepted by science. All the other claims are straightly refused.

Table 1
Descriptive statistics of the alkaline RKC's knowledge claims.

Claim attributes	N	%
<i>Degree of refusal by science</i>		
Accepted	8	4.2
Partially accepted	8	4.2
Controversial	3	1.6
Partially refused	13	6.8
Refused	148	77.1
Irrelevant	12	6.3
Total (N,%)	192	100.0
<i>Type of repertoire</i>		
Bio-molecular	84	43.8
Eco-systemic/holistic	69	35.9
Political	39	20.3
Total (N,%)	192	100.0

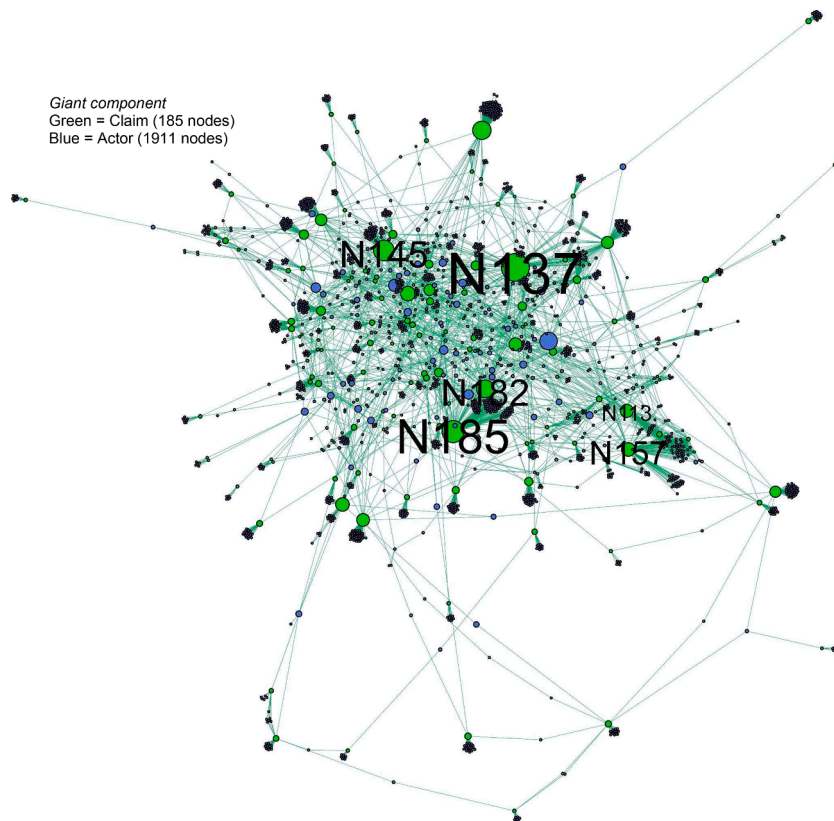


Fig. 1. Two-mode network of claims and actors (giant component). Node size is set according to betweenness centrality; label size is set according to degree centrality.

Communities 2 and 6 both contain the largest number of claims (18 claims), which are concerned with the refusal of institutional medicine's approaches and treatments, although addressing different health issues and pursuing different strategies. Indeed, claims in community 2 focus mostly on the health policies promoted by Italian scientific institutions to counter the spread of the COVID-19 pandemic (including actors like 'vaccines', 'masks', 'green passes'⁶). In this discourse, epidemiological data on the pandemic

⁶ The Green Pass, namely the "COVID-19 Green Certificate", was the document that enabled people to access most public places in Italy during the COVID-19 pandemic period. This document attested to "one of the following criteria: vaccination against COVID-19, a negative antigenic or molecular swab taken within the last 48 h, or recovery from the infection" (<https://www.salute.gov.it/portale/nuovocoronavirus/dettaglioNotizieNuovoCoronavirus.jsp?lingua=english&menu=notizie&p=dalministero&id=5531>, accessed January 24th, 2024).

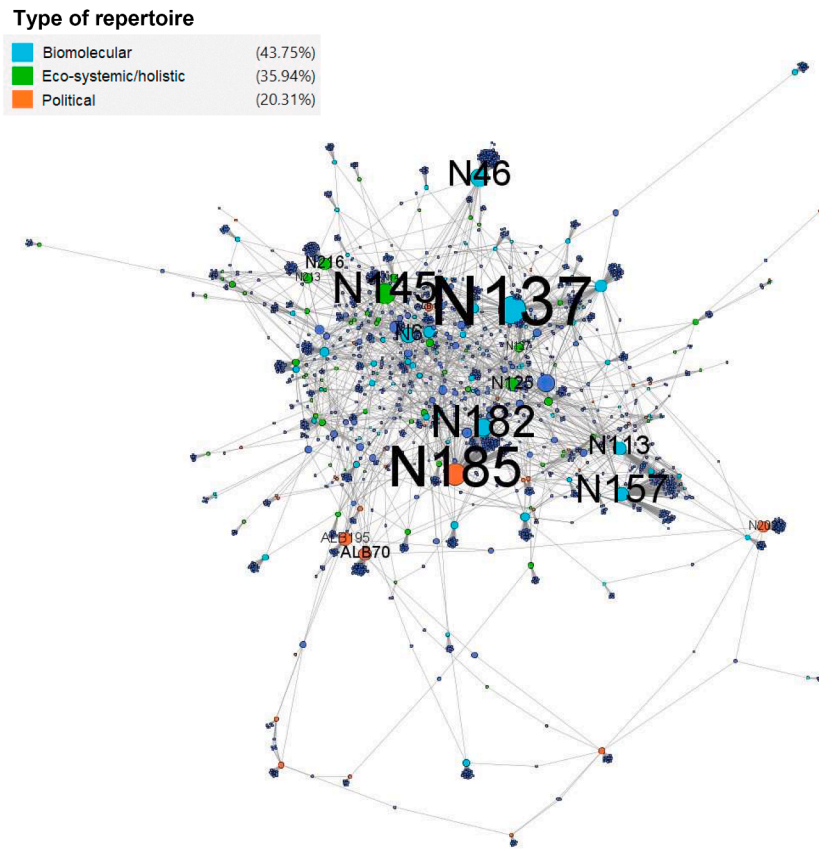


Fig. 3. Two-mode network of claims and actors. Node size is set according to betweenness centrality; label size is set according to degree centrality. Colours are based on the repertoire type of the claims.

Table 3
Composition of communities (modularity classes).

Modularity class	Repertoire (% claims)			Degree of refusal by science (% claims)*			
	Bio-molecular	Eco-systemic/holistic	Political	Accepted/partially accepted	Refused/partially refused	No. of claims	No. of actors
2	16.7	27.8	55.6	0.0	100.0	18	126
6	16.7	50.0	33.3	22.2	66.7	18	79
11	14.3	78.6	7.1	7.1	71.4	14	111
23	33.3	41.7	25.0	0.0	83.3	12	71
15	81.8	18.2	0.0	9.1	90.9	11	143
5	18.2	36.4	45.5	0.0	81.8	11	56
17	80.0	20.0	0.0	10.0	90.0	10	163
4	44.4	55.6	0.0	11.1	77.8	9	81
13	44.4	22.2	33.3	22.2	55.6	9	48
22	62.5	37.5	0.0	0.0	100.0	8	78
21	50.0	25.0	25.0	0.0	100.0	8	74
14	62.5	37.5	0.0	12.5	75.0	8	57
3	16.7	83.3	0.0	16.7	83.3	6	146
8	100.0	0.0	0.0	0.0	100.0	6	124
1	33.3	16.7	50.0	16.7	83.3	6	78
25	100.0	0.0	0.0	0.0	100.0	6	31
18	40.0	60.0	0.0	0.0	80.0	5	49

* The percentages of the categories “Irrelevant” and “Controversial” are not shown in the table.

released by scientific institutions are contested, and fear generated by the so-called *health dictatorship* is itself deemed the cause of diseases; at the same time, even the COVID-19 virus is enrolled to support alkaline treatments. The proportion of repertoire types in this community – where all the claims are refused by science – reflects the combination of narrative styles in this RKC: although here the political side is prominent, the narratives against COVID-19-related policies are combined with the holistic repertoire, which

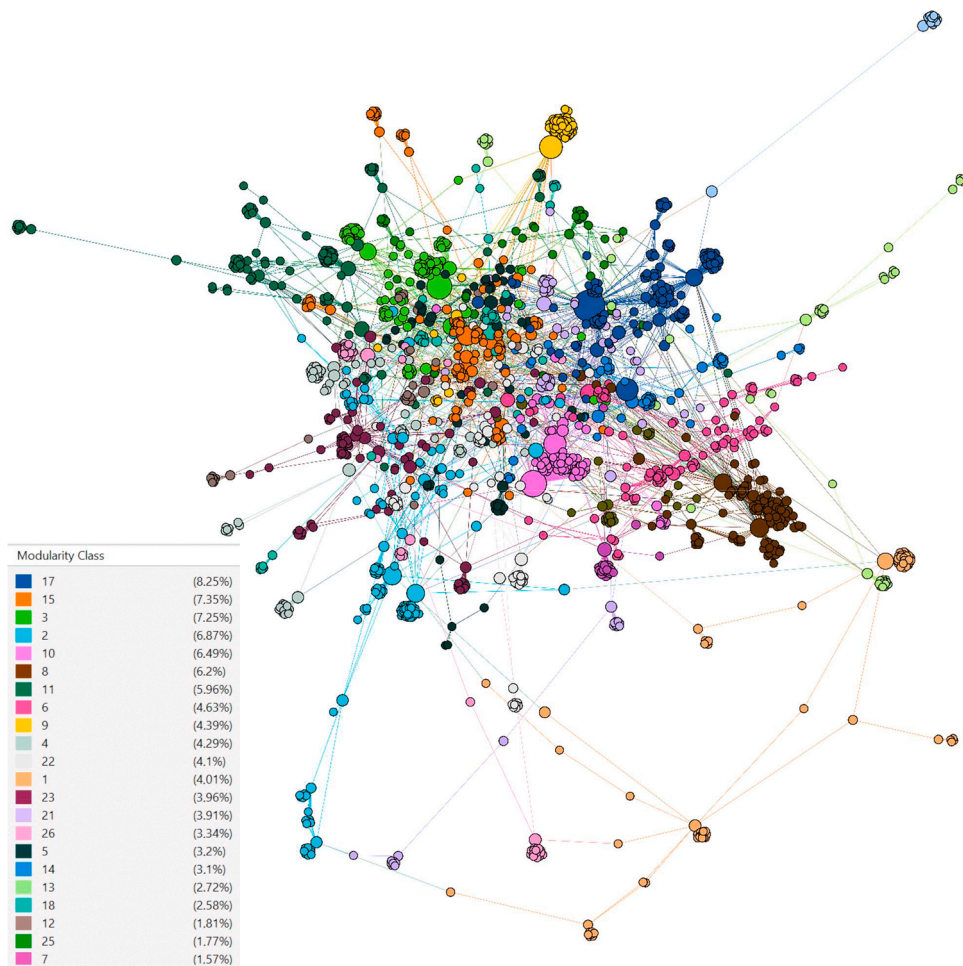


Fig. 4. Two-mode network of claims and actors. Node size is set according to betweenness centrality; colours are set according to modularity classes.

highlights the importance of boosting the immune system (also by alkaline drinking and eating habits), and the bio-molecular repertoire, which leads to rely on explanations that mimic scientific arguments (e.g. “alkaline water protects against viruses”).

In modularity class 6, discourses are mostly centred on criticism of Western medicine’s approach in general, and on the related cancer treatments in particular. The eco-systemic/holistic repertoire (50 % of the claims), combined with the political repertoire (33 %), is predominantly used to counter this approach to medicine (which, indeed, is deemed insufficiently holistic), while the bio-molecular repertoire (16.7 % of the claims) is only partially used to provide alternative explanations for the development of disorders to those provided by official science.

Communities 11 and 3 are representative of the eco-systemic/holistic domain, with the related repertoire being prominent. Indeed, the knowledge domain characterising these communities is markedly oriented to improve one’s own self-awareness and stimulate positive energy in the mind-body system, with knowledge claims aimed at legitimising the adoption of a lifestyle centred on an alkaline diet to prevent disease and to live a healthy, high-performance life. Consistent with these traits, in community 11 the claims refused by science (about 70 %) join around 20 % of claims that are deemed not of scientific interest (irrelevant), with ‘inflammation’ and ‘lymphatic system’ being the most central actors – the latter denoting a key element in the narratives of a promoter of alkaline diet. Likewise, in community 3, central actors like ‘energy’, ‘mental clarity’, and ‘tiredness’, work well with a narrative appealing to high-performance people (entrepreneurs, professionals, etc.). In addition, community 3 is one in which non-refused claims are combined with refused ones, as the former are needed to sustain mundane narratives related to wellbeing.

The claims of communities 23 and 5, which are tightly connected in the graph, contribute to conceiving of health as the result of self-awareness and self-healing – in this case it is more of a ‘new age’ conception of the individual than that of a performing body, conveying an idea of purification where responsibility for the cure is attributed to the individual. However, the relevant narratives also appear in a marked political vein (the political repertoire characterises 45 % of the claims in community 5), attacking the ‘System’ that “wants us to be sick” and leads people to be separated and dependent on its powers, as well as against Western medicine and the economic interests connected to it (i.e. pharmaceutical industries) – specifically in community 5, where the claim with the highest

betweenness centrality is ALB15, "Drugs do not solve health problems and are harmful" (see also Table 2).

An opposite pattern is observed for community 13, with a mixture of accepted and refused claims (two claims are also irrelevant and controversial) and a concern for cancer; here the political side revolves around criticism towards the institutions (e.g. politicians, WHO, lobbies) and enrolling scientific actors. This exemplified by the topology of communities 23 and 13, which lie on two opposite sides of the graph and are entirely disconnected to each other. In addition, community 23, on the left in the graph, is more concentrated, while community 13, on the right, is far sparser, and this is due to the inter-group ties that make the latter community more widely connected to the rest of the graph.

Several communities are noteworthy for their polarization as they combine a vast majority of claims pertaining to the bio-molecular repertoire and the highest proportion of refused claims. In community 15, the claims focus mostly on the benefits of alkaline water and food, relying on an alleged scientific basis (see for instance the claim N6 in Table 2). The tenor of the narrative on these benefits also inheres to the actors assembled in this community: 'blood', 'bones', 'pregnancy', 'calcium', 'metabolism', 'enzymes', 'vitamins', and so forth. As for modularity class 17, every claim is concerned exclusively with alkaline water and its benefits, and the topology of the community reflects its homogeneity, featuring not only the most central claim in the entire network (N137, see Table 2) but also the most central actor in the network, namely the 'ionisers', followed by the brand of a large, international company active in the relevant market. Communities 15 and 17 are definitely the 'pure' alkaline assemblages of claims and actors and lie, in fact, in the core of the graph.

Community 8 is one where the above polarization is far more noticeable. Here the main theme is the link between alkaline water and the treatment of cancer (see claim N157 in Table 2), with many scientific actors mobilised to sustain these claims. Interestingly, while this community is concentrated in an almost distinct area of the graph (bottom-right), three of its actors are instead positioned in the core of the graph, namely 'cellulite', 'alkaline minerals', and 'free radicals'. This community is, then, extreme in the tenor of the claims, but also holds actors that are enrolled not to avoid associations with less extreme concerns. A similar polarisation occurs for community 25, where the claims are focused on alkalinisation, pregnancy and the condition of the intestine.

In sum, the political repertoire is never dominant in the communities yielded by this procedure. Instead, it always stands alongside other types of repertoires. The bio-molecular repertoire is, instead, prevalent more often than the above repertoire: the relevant claims turn out to be assembled in coherent discursive substructures where science is challenged. Where the claims partially or totally accepted by science are present, more balance amongst the three repertoire types is observed: science is contested and enrolled at the same time. Anyway, while the composition of modularity classes reveals the distinctive features of these substructures, a further analytical tool is needed to disentangle the different cognitive and practical dimensions of knowledge that best represent this RKC. Through MCA applied to the network of claims and actors we shall then provide an assessment of the core tendencies mostly relevant to this RKC.

4.3. A map of refused knowledge: representation of the alkaline RKC through MCA

The representation in Fig. 5 is a joint factorial map where both claims and actors are visible, along with the attributes of the claims. The factorial solution relies on 28 instead of 192 claims, as the procedure preliminarily drops out the active categories with small weights (i.e. those with frequencies under the threshold of 2 % of all individuals). These 28 claims are amongst those with the highest degree centralities in the network and 23 out of them are refused by science (see Table B2 in Appendix B). This gives the results of the

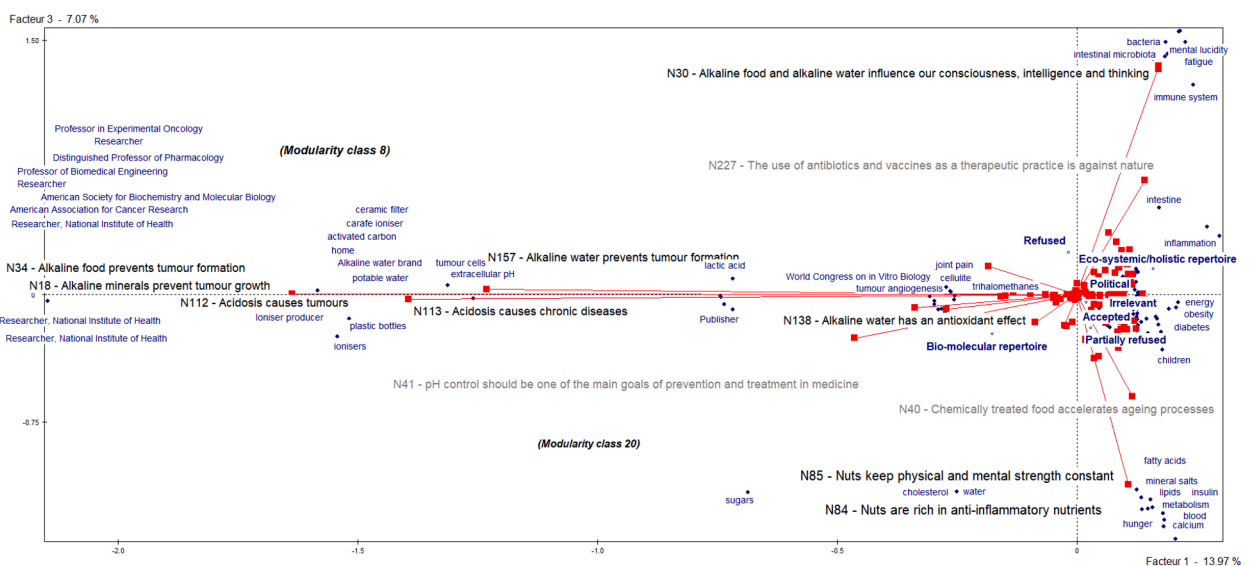


Fig. 5. Representation of the alkaline RKC through MCA. Plane of the first and third factorial dimensions (claims in grey are not contributing to the factorial dimensions but their positions is statistically meaningful to interpret them).

Table 4
Factorial dimensions of the MCA solution.

Axis	Eigenvalue	% of inertia	Cumulated % of inertia
1	0.1397	13.97	13.97
2	0.0773	7.73	21.70
3	0.0707	7.07	28.77
4	0.0660	6.60	35.36
5	0.0612	6.12	41.48

MCA a selective character which, however, retains relevance as it leads us to focus on the most representative claims of this RKC. Nonetheless, some claims having high test-values will be helpful in interpreting the factorial dimensions even if they do not contribute to determining them analytically. For the sake of better visualisation, the diagram in Fig. 5 shows the first and third dimensions, with a minimum loss of quality (see the eigenvalues in Table 4), and the mode of representation is the one with the modalities placed at the barycentre of the individuals instead of the standard simultaneous representation of individuals and modalities.

The map reveals quite clearly a pattern of the claim-actor relational structure that partly recalls the distinction between different modes of pursuing discourse to sustain refused knowledge. Here it is clearer that the claims that are focused on a sensitive subject to be dealt with, that is, cancer and its treatment, lie on the extreme side of the alkaline knowledge domain. On the left-hand side of the map, the claims N34, N18, N112, N113, and N157 are those with the highest contribution to the first axis – and, indeed, those which contribute almost exclusively to this dimension (see Table B2 in Appendix B). These claims relate to alkaline water and food as well as to acidosis and its consequences for health; close to them lie actors that belong to the scientific domain (researchers, scientific institutions and universities, and mostly authors of relevant scientific papers). Indeed, here a connection to modularity class 8 (see Section 4.2) is found: the above claims belong to that community, expressing the link between alkaline water and the treatment of cancer and the mobilisation of scientific actors to sustain such claims.⁷

Indeed, scientific actors qualify the entire left-hand side of the map and, by reason of their location on the factorial plane, they strongly characterise these claims, which, interestingly, tend to have the same pattern of actors' enrolment (the angle separating the vectors representing them is small). In other words, to sustain these claims, the same actors are enrolled, on average.⁸ Indeed, the latter are not only scientific actors but also elements of the narratives permeating the alkaline water market, like the relevant brands, the ionisers, and even plastic bottles or potable water. A publisher highly involved in disseminating refused knowledge – but also other genres that can be sympathetic with the same readership, like books on homoeopathy or self-consciousness, along with other non-scientific subjects – is also visible here. Elements of human physiology, as well, are present on the left-hand side of the plane, like extracellular pH. Hence, on this side of the map the bio-molecular repertoire prevails; some actors belonging to narratives of human physiology are also present on the right-hand side of the map, but turn out to be framed differently because different claims at play here are more concerned with lifestyles and food habits, or with socially diffuse diseases like diabetes or obesity – the latter being conditions of the body that partly depend on one's lifestyle and self-awareness. In sum, the horizontal axis opposes the bio-molecular repertoire to the eco-systemic/holistic repertoire, and stands for a dimension associated with the severity of the concern (more severe on the left, less severe on the right) and the significance of the actors enrolled to sustain refused knowledge. On average, in fact, the location of the points denoting the bio-molecular and the eco-systemic/holistic repertoires appear as highly unrelated. The opposition between these two repertoires is also apparent when considering the vertical axis. Amongst the claims characterising this dimension is N40 – “Chemically treated food accelerates ageing processes” (dropped, but still meaningful for interpretation on axis 3; see Table B2 in Appendix B).

The third dimension (vertical axis) is characterised by claims N85 – “Nuts keep physical and mental strength constant” and N84 – “Nuts are rich in anti-inflammatory nutrients” on the lower side; while N30 – “Alkaline food and alkaline water influence our consciousness, intelligence and thinking” and N227 – “The use of antibiotics and vaccines as a therapeutic practice is against nature” are on the top. Note that claims N84 and N85 (which share exactly the same position), and N30 characterise the lower and upper sides of this dimension, respectively. On this axis, the narratives of the alkaline RKC are divided in two main strands: the one on the bottom-right pertains to the way one has to manage her/his wellness by eating healthily and keeping some parameters under control, as well as by taking care of metabolism; the one on the top-right is instead chiefly holistic.

The vertical axis is, hence, the dimension of everyday concerns relating to health that refer either to a more medicalised lifestyle (on the bottom) or to a lifestyle more inclined to take care of a mind-body connection (actually, the intestinal microbiota is amongst the relevant actors, placed on the extreme upper side of the vertical axis) and of a humanity-nature connection as well (on the top). It is, in a sense, a two-fold perspective on individual self-healing that implies the responsibility to behave in a healthy and/or thoughtful manner. As for the degree of refusal of the claims, the modality ‘Refused’ is opposed to all other categories of this variable and, as it concerns most of the claims, it also lies in between two groups of claims that characterise the two dimensions considered. Here, a statistical perspective may help assess the position of the label ‘Refused’ on the map. Recalling that illustrative individuals derive their position on the map from the average of the positions of active categories, this attribute is slightly distant from the axis origin because of a clear pattern (as the same as the bio-molecular repertoire) and not ‘by chance’, as is the case with the attributes denoting

⁷ The map also shows a reference to modularity class 20 (not shown in Table 3), which is connected to modularity class 8 in the network graph.

⁸ It should be noted that the labels identifying social media users are not shown in the map, while those denoting scientists are anonymised.

acceptance by science. The latter case is, instead, an instance of being closer to the average profiles of active categories in the factorial solution, denoting a lack of distinctive patterns in reference to the claims.

5. Discussion and conclusions

In this article, we have tried to show how knowledge refused by scientific institutions can be mapped and analysed by conceiving of it as a two-mode network of claims and heterogeneous actors enrolled in discourse to sustain these claims. Our theoretical contribution revolves around the awareness that, in an RKC, meanings and practices articulate also different narratives, including those of institutional science. Although these communities are certainly concerned with “challenges to the epistemic authority of science” (Mede & Schäfer, 2020), RKC’s attempts to reframe scientific knowledge can only in part be explained by the current labels of *post-truth* or *science-related populism*. Indeed, their complexity requires greater attention and a deeper understanding of the ways in which they set forth knowledge claims totally or partially refused by institutional science.

In this sense, building a map of refused knowledge would be useful to consider the diversity of perspectives within a collective world and the performative character of the discourses set forth therein. This requires paying attention to the way RKC’s revolve around common concerns and shared meanings, avoiding flattening any understanding of those concerns and meanings (Harambam, 2020; Lynch, 2020; Prasad, 2022). Hence, in this work we have provided an attempt to map RKC’s discourses in order that the latter’s cognitive organisation becomes apparent and the patterns constituting it be subject to sociological analysis.

The way we wanted to pursue the task of mapping refused knowledge, in order to highlight the patterning of relations between elements of the related discourse, was using network-analytic techniques, so as to frame the study in a key relational perspective (Emirbayer, 1997). Recently, a similar attempt has been made by Vedres (2022) to analyse the patterning of economic policy discourse. This study is pursued in the same vein, although by a different analytical strategy. Relying on both ANT and SNA, the current work thus aimed to frame the analysis of online communities supporting claims of knowledge refused by science, in order to “map out the structure of meanings within narratives” (Mohr, 1998, p. 358).

For instance, Harambam and Aupers (2017) adopt a relational perspective to understand identification processes of conspiracy theorists, conceiving of the conspiracy milieu as “a relatively open social network providing cultural resources for identity construction” or, better, as “a fluid network of different groups of people, identifying with distinctly different worldviews, beliefs, values and practices” (Harambam & Aupers, 2017, pp. 116, 125). The RKC’s community structure (Section 4.2) shows that political instances seem not to go alone, and a conspiracy-like tendency to attack the establishment in its different versions – the state, the economy, ‘Big Pharma’ etc. – tends always to be associated with the fields of wellbeing and medicine in a complex network of associations (Latour, 2005). In this sense, there is no ‘pure’ conspiracy theory but, instead, an entanglement of mutually reinforcing motives where political discourse and actors are enrolled to sustain refused knowledge claims regarding health, and vice versa. This happens forcefully, for example, when COVID-19 narratives and counter-narratives are at issue.

In this respect, the alkaline RKC also appears as a good candidate to express a form of political polarization of science (Rekker, 2021) as far as there is evidence of the interplay between scientific claims and political beliefs. However, this interplay also makes this RKC more of an intricate social world than a coherent whole (Picardi et al., 2024), and its ambivalence as a discursive space may be noteworthy in the way it resonates the current condition of epistemic instability (Harambam, 2020).

Furthermore, and quite paradoxically, trying to enrol science might be coupled with uttering claims refused by science. In the assemblage of different claims resulting from community detection, the bio-molecular repertoire tends to be prevalent where also a high degree of refused knowledge prevails. This can also be appreciated on the factorial map of Fig. 5, where the bio-molecular repertoire and the ‘refused’ attribute of claims stand on the same side of the horizontal axis. Notably, the latter dimension is one denoting the severity of the concerns regarding health and wellbeing; and the more severe the concern, the more scientific are the actors enrolled in discourse. However, such claims by which to enrol science turn out to be markedly extreme and with no reliance from a scientific point of view, but at the same time they need to mimic scientific discourse to be legitimised. When it comes to the other side of the map on this dimension, the concern is more relaxed, and the repertoires are different: these are relevant to more ordinary preoccupations, which to cope with by embracing an alkaline lifestyle.

In conclusion, although several limitations of the current paper – some of which might be related to subjective biases in coding and non-univocal results obtained from community detection – warn us against absolutizing or reifying our findings, this work shows that, in RKC’s, attribution of credibility to forms of refused knowledge might not be built within what Collins and Pinch (1979, pp. 239–240) have identified as the *constitutive* forum of science, e.g. through canonical procedures of empirical validation in the laboratory and publications, even though these are enrolled in RKC’s discourse. Instead, such knowledge seems to be framed through patterns of relationships between actors that characterise the discourse that dominates the *contingent forum*, where actions “are not supposed to affect the constitution of ‘objective’ knowledge”.

Funding

This article relies on the research project PRIN 2017B434E8 “Social factors and processes affecting the acceptance of fake scientific knowledge” granted by the Italian Ministry of University and Research (MIUR). The project was led by the University of Padua, together with Polytechnic of Milan, Catholic University of Milan and University of Naples Federico II.

CRedit authorship contribution statement

Marco Serino: Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Ilenia Picardi:** Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Giancarlo Ragozini:** Supervision, Methodology, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.poetic.2024.101929](https://doi.org/10.1016/j.poetic.2024.101929).

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