

"Controversy Mapping shows how we can use social research to bring controversies back to the surface of knowledge and public life, and how it can help to recover the power of controversy to transform what's possible. The book provides everything you need – the ideas, examples, and techniques – to start doing controversy analysis."

Noortje Marres, University of Warwick

"Venturini and Munk have produced a significant book that traces the genealogy of controversy mapping back to its origins in actor-network theory to its incarnations in digital methods. Through a lucid and engaging narrative and series of visualizations, they provide a comprehensive 'field guide' to the major figures, theories, concepts, and methods that make up the practices of controversy mapping."

Evelyn Ruppert, Goldsmiths, University of London

As disputes concerning the environment, the economy, and pandemics occupy public debate, we need to learn to navigate matters of public concern when facts are in doubt and expertise is contested.

Controversy Mapping is the first book to introduce readers to the observation and representation of contested issues on digital media. Drawing on actor-network theory and digital methods, Venturini and Munk outline the conceptual underpinnings and the many tools and techniques of controversy mapping. They review its history in science and technology studies, discuss its methodological potential, and unfold its political implications. Through a range of cases and examples, they demonstrate how to chart actors and issues using digital fieldwork and computational techniques. A preface by Richard Rogers and an interview with Bruno Latour are also included.

A crucial field guide and hands-on companion for the digital age, *Controversy Mapping* is an indispensable resource for students and scholars of media and communication, as well as activists, journalists, citizens, and decision makers.

Tommaso Venturini is a researcher at the CNRS Center for Internet and Society, and co-founder of the Public Data Lab and of the médialab of Sciences Po.

Anders Kristian Munk is Director of the Techno-Anthropology Lab at the University of Aalborg and co-founder of the Public Data Lab.

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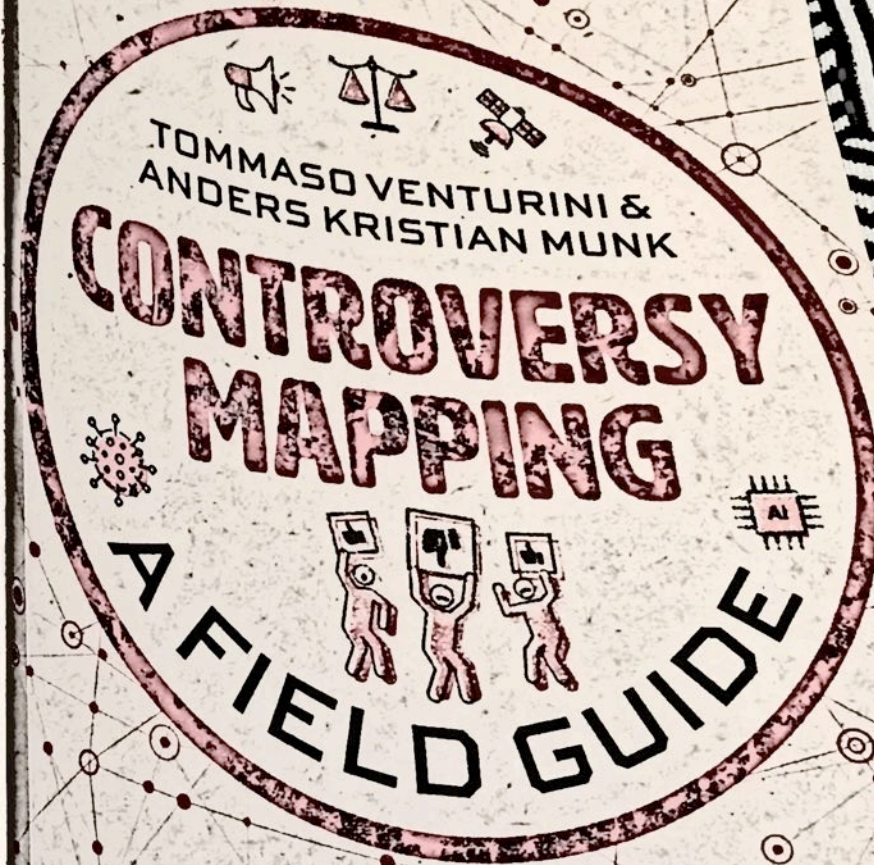
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CONTROVERSY MAPPING

VENTURINI
& MUNK



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Richard Rogers. Preface: the politics of association on display

Preface: The politics of association on display

Richard Rogers

As this book aptly demonstrates, there is a certain fit between Actor-Network Theory (ANT), controversy mapping, and digital methods. From the outset, the methods were informed by ANT and sought to operationalize it. The book is a map, for the purpose of investigating imbrolios such as the one in the book. They did so in at least three ways: putting actor associations on display through link mapping, furnishing a coarse view of actor associations through mention mapping, and inserting the maps into the issue spaces. They are part of it rather than only representations.

As Venturini and Munk discuss, associations are the main focus of the prime way in which controversies are fought and societal structures are established. In order to put actor association on display, colleagues capture how websites link to one another. Long before the internet, there was automation, and eventual decline of the hyperlink (in favor of the "follower," and very differently the "hashtag"), each link was a capricious and selective. Hyperlinking practices thus remind us of the webmaster, with particular proclivities or even policies. Linking, which scientists use references to mark their positioning in the network, but we extended these associational practices to a much larger number of actors.

Once mapped, these links could be telling. One could profile the players in a public dispute beyond their usual role in the chapter about controversy actors. They could be profiled in which they linked and were linked to. Who does the actor receive those particular inlinks? Which link is conspicuously missing?

We found certain types and styles of association. There were actors desiring association with another actor. There was cordial linking, where actors link to the same space. There was critical linking, with addressees of an issue or problem. There were of non-linking, self-linking, kinship linking, trans-

Like Google, we also discovered that the sum of one's in-

Figure 0 Mapping the online mentions of rare elements (created by Richard Rogers and Federica Bardelli)

everywhere in contemporary media. It is impossible to follow one's social feed, or listen to a podcast without encountering a social issue.

Of a seahorse gripping a cotton-bud in its curvy tail, the effects of plastic pollution on marine ecosystems. Published by an American photographer and environmentalist, the image goes viral on social media and soon gives rise to a discussion.

A tropical cyclone adds fuel to a discussion about climate change and extreme weather events. TV and the internet are an interest in climatologists who can explain how increased storm activity. Once on air, the discussion moves to consequences, as architects and engineers suggest that the blame should be placed on poor urban planning and not on the weather. The discussion then turns to the government of not fulfilling its commitment to change.

The World Trade Organization is met with criticism against the adverse consequences of economic globalization. Poverty in the Global South. The demonstration takes place. The activists have organized for months through an online system and use social media to create improvised flash mobs in the city.

A group of endocrinologists and environmental scientists publish in a prestigious international journal urging governments to take action against the use of commonly used chemicals in agriculture and cosmetics. The chemicals are being carcinogenic and causing hormonal disorders. The scientists call for a lack of regulation, but also a media campaign by industrial companies to promote a false sense of scientific uncertainty around the chemicals.

The CEO of an online platform is called to testify before Congress after a data leak exposing millions of its users and their personal information. The platform is accused of running rampant marketing schemes and deceptive political campaigns.

A conversation with Bruno Latour

A conversation with Bruno Latour

"A mix or maybe a mess of ideas"

Bruno Latour (BL): The adventure of controversy mapping started about 30 years ago. At the time, we had a very specific problem: to teach science studies to the engineering students of the École des Mines without triggering all sorts of odd reactions. I was inspired by the tradition of controversy studies that colleagues such as Steven Shapin and Harry Collins had developed in England and I was trying to do the same thing in teaching. I did not want to complicate the lives of the engineering students too much and yet have them absorb the strange notion that society is important in science and technology. It seemed to me that a good idea was to let the students choose a topic that was not already settled and then have them do a little bit of inquiry. I had learned that from Harry Collins, Andrew Pickering, and Wiebe Bijker, who was teaching in Twente and working along the same lines.

The digital aspect arrived a few years later, when a student had the idea to use a website for what we had been doing on paper boards or by staging simulated debates. It was just the beginning of the Web, really, but the idea stabilized quickly: in a year or so, everybody was doing websites.

Finally, the notion of cartography came from the work that Michel Callon was doing on co-word analysis and scientometrics at the Centre de Sociologie de l'Innovation (CSI) at the École des Mines. In fact, the actors of the early Web were themselves experimenting with this type of analysis (the old AltaVista system). So, we just grabbed all those cartographic metaphors. I'm not sure it was the best idea, but it did stick.

Tommaso Venturini (TV): Yet, mapping is not the only metaphor that one could use for digital research. Nowadays, most scholars prefer computational metaphors like counting, computing, or calculating. Why did you go for mapping instead?

BL: I don't think it came from a great theoretical insight at the time. We had co-word analysis, which was called maps, and I had directed a thesis by Genevieve Teil on what would now be called artificial intelligence, using co-word analysis. It was a time of enthusiasm. The other connection was my work on Gabriel Tarde

90 images (redesigned by Federica Bardelli)

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- 62 The planet Melancholia
- 63 Lars von Trier
- 64 Lynn Margulis carving a
- 65 responsible for the Great Oxid
- 66 Two of the first and most
- 67 space, Earthrise and The Blue
- 68 that Tommaso first suggested the idea for this
- 69 year stint as a visiting researcher at the Sciences
- 70 was the research coordinator, and we had both
- 71 pedagogy of controversy mapping was learned by
- 72 experimental with a high level of engagement and
- 73 the students, yet the need was felt to compile the
- 74 all working on into more structured formats.
- 75 in those years to consolidate the ongoing
- 76 mapping. One was the curation of a collection
- 77 and the world were producing as part of their
- 78 RCAST project (FORmation par la Cartographie
- 79 Sciences et des Techniques) which had been
- 80 research-based understanding of the pedagogy
- 81 was missing, we thought, was a book. Tommaso
- 82 erials into a portfolio which became the first
- 83 since developed and transformed through more
- 84 think of. We are proud to see it emerge now as
- 85 roversy mapping, not just for teaching, but also
- 86 ury. This would not have been possible without
- 87 expanding and highly committed network of
- 88 we want to credit and thank.
- 89 sted as a pedagogic practice in Science and
- 90 ie early 1990s, and Bruno Latour has played a
- 91 ception at a time when mapping projects were
- 92 to its later digital adaptations. He is also the
- 93 ok first met and we can safely say that it would
- 94 im. We first got in touch more than a decade
- 95 nds of Bruno's MACOSPOL project (Mapping
- 96 ics - the first large-scale research project dedi
- 97 as teaching controversy mapping on the MSC

An introduction (with a full mapping example)

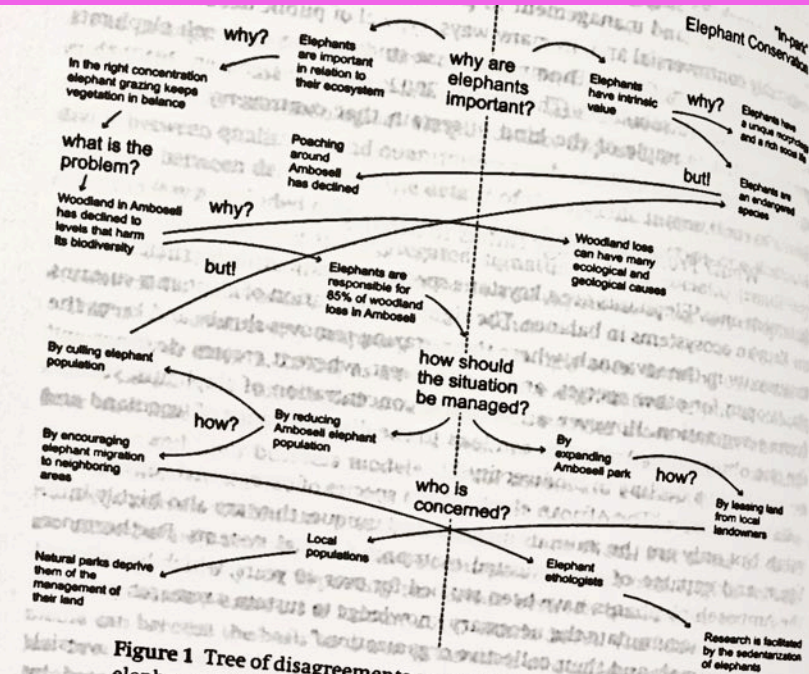


Figure 1 Tree of disagreements around the conservation of Amboseli elephants. Western's position and its associated knowledge claims and prescribed actions on the left, Moss's position on the right. Main battle line in the middle (created by the authors based on the account provided by Thompson, 2002; released by the authors under CC BY-SA 4.0).

of fact, but attempts to prescribe how a situation should be handled. The first statement above is not only an observation on how elephants interact with their environment, it is also a "speech act" (Austin, 1962; Searle, 1969) meant to curb the numbers of Amboseli elephants, by encouraging them to migrate from the park. Likewise, the second statement is not a generic praise of elephants; it is a specific plea for protecting Amboseli's elephant population within the established structures of the national park. In sociotechnical controversies, statements are always connected in arguments and arguments are always set forth as proposals for action. In controversies, knowledge is always enmeshed with politics.

Who? From debates to actors

Showing that a knowledge claim is always an argument in a debate and a call to action is the first step. The second is to clarify how these debates are inseparable from the actors that stage them. A trivial way to understand this connection is to simply recognize that the action-agendas enabled by specific knowledge claims tend to be connected to the position of the actors who make the claims. In Thompson's example, it is telling that arguments similar to those summarized in the first statement above were voiced during the Amboseli workshop by a local conservationist, David Western, who was at the time the director of the Kenyan Wildlife Service and, as such, in charge of conserving national biodiversity. And arguments similar to those summarized in the second statement were made by an American ethologist, Cynthia Moss, who was renowned for having studied the elephant population in Amboseli for more than 20 years. Associating knowledge claims with the actors that state them thus makes it easier to appreciate the opposition between a position centered on the conservation of the overall ecosystem and a position focused on safeguarding the elephant community. It also suggests that while defending different land management strategies, Western and Moss were also defending their respective careers.

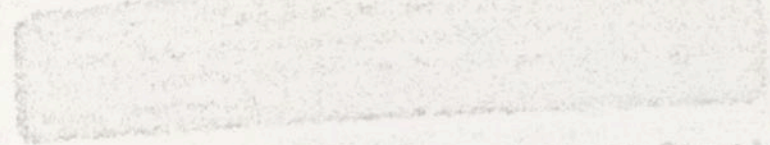
Unveiling power struggles behind intellectual positions is a classic move in the sociology of science. Within controversy mapping, however, it is not enough to recognize that different experts can have different stakes in a debate. In practice, what this recognition often entails is that the very substance of what is being discussed has radically different meanings for the different actor positions. For instance, the disagreement between Western and Moss about how nature should be conserved at Amboseli can be traced back to the different meanings that each of them attached to the notions of "nature" and "conservation" – Thompson (2002) calls it "competing philosophies of nature."

As an ecologist, David Western was trained to consider nature as the general balance between flora and fauna, while Cynthia Moss, as an *ethologist*, has built her expertise around one key species, the elephants. Beside this general disciplinary gap, the visions of nature of the two scientists were also manifested in their different observational practices and settings. Moss had a long experience observing the elephants of the park, having spent several years living with them. She had named each member of the herd and compiled the life history of many of them. The practice of naming animals is common among ethologists and extremely useful when collecting longitudinal data over extended time periods where interobserver identification must be facilitated. Yet, it is often criticized for the risk of anthropomorphizing the animals and considering them individually rather than as part of an ecosystem. On the other hand, Western's appraisal of the situation rested on a series of experiments that he pioneered using

Part One: Features of controversial landscapes

Part One

Features of controversial landscapes



Controversy and to get something caught up in this mode. This can be both outward and inward. And it takes the attention of who you intend to engage with. Controversy mapping is the first place. It was the first place with a specific viewpoint. Mapping a controversy can seem like a waste of time. If you know who is right and who is wrong, why bother representing the other point of view? If all you want is to try a little. There are more efficient ways to do it than through mapping. But when you genuinely want to help others that share your view around the globe, you will find that mapping is a better way to achieve it than any other and if the outcome is better.

By treating controversy as "geographic events" (Lippman, 1993), it can be possible that need being the is attention to controversy. Maps, which are the social fabric of today's transformation, represent a complex landscape over which we are rather than representing them away. This landscape is not always welcomed and the very act of making something a controversy can lead to controversy. Indeed, making the complexity of a controversy, including the various directly contrary to the agenda of those who rely on the landscape to begin their point. It makes you feel you try to be impartial, as a controversy is an either/or conflict or irrelevant. It becomes a landscape of a controversy by the question, then, is not how to keep your mind from being taken by the way you see the world.

In 2013, we were working on a research project exploring the use of maps to Maps to Assist Public Science (MAPS) around climate change (Lippman et al., 2013). One of the things we worked with was vulnerability assessments, which are warning countries' exposure to climate change impacts and their ability to distribute adaptation risk. One of the maps we produced (Figure 1) shows the most common climate vulnerability assessment scores of regions.

Ch1. Why map controversies?

...at least to be reflexive and transparent about your motives, as in part 3 of the creed. You might attempt to open a space for democratic inquiry, as in the example above, or to show how different commitments produce different outlooks or how different knowledge claims have authority in different groups. You could also aim to help decision makers, journalists, or other actors to make sense of the debate or take a stance in it. The point of your mapping could be to highlight different perspectives to help those who will eventually design a solution to do so in fullest view of the concerns they have to balance. Last but not least, the point of mapping a controversy could be to exploit an opportunity to do interesting research. It is not every day that you have the possibility to observe how economic, social, and ecological indicators are balanced against each other to produce the combined assessment of a country's vulnerability and how this is a source of struggle behind the front desk communication of international aid.

Accepting complicity as a mapmaker

In his history of cartography, John Wilford (2002) recounts how, in the early days of aerial surveying, cartographers were occasionally attacked by people on the ground who mistook the mappers for a threat and met them with spears and arrows. Critical geographer Patrick McHaffie, however, suggests a different reading:

Perhaps the "frightened Africans" who once "threw spears at an Aero Service aircraft" or the "suspicious moonshiners in Appalachia" who "took a few rifle shots" at aerial mappers did so not because the intentions of the mappers were "not always understood," but because those intentions, and the powerful forces behind them, were understood only too well. (McHaffie, 1995, p. 122)

Maps are not just tools for navigation but also instruments of power and appropriation, subversion and resistance, leverage and negotiation. This has been demonstrated time and time again in critical geographical scholarship (Harley & Woodward, 1987; Harley, 1989; Turnbull, 1994, 1998; Pickles, 1995, 2004; Corner, 1999). As Eileen Hooper-Greenhill notes: "to be 'on the map' is to be acknowledged, given a position, accorded an existence or an importance" (2000, p. 17). Whether such recognition is desirable or not depends on the situation. The scientist chasing funding or the NGO striving to set the public agenda will likely want to be charted as influencers. Yet, while being left off the map can consign you to oblivion, it can also grant you protection. A group of indigenous people resisting appropriation by a state will likely not want to be mapped. Flood insurance do not want to see their property on a



Denmark spies and analyzes critical world citizens.

Posted on February 28, 2014 by Nnwc6734 • 0 Comments

A Danish study, paid by the taxpayers (€2.6+ million) has to ensure to stop protests and interruptions in the implementation of wind power projects. This study is supported by the beneficiaries of wind power under the leadership of the world's largest wind turbine manufacturer Vestas, hand in hand with Siemens and Vattenfall in Denmark.

Figure 8 Controversy mappers accused of spying on wind turbine opponents. Meme circulated worldwide by anti-wind websites, including the European Platform Against Windfarms, caricaturing a controversy mapping project carried out by one of the authors (Munk, 2014) as Nazi and authoritarian.

(Munk, 2010). Maps matter and this is true for geography as well as for controversies (November et al., 2010).

While working on a project on energy transitions, one of us was tasked with mapping online debates about wind farms (Munk, 2014). The sample included wind energy advocates and opponents from several countries and the project was to trace their hyperlink connections and the issues present on their websites. Some of the early maps found their way to protest groups who reacted vehemently and decried them as an example of how the wind industry was spying on them. The maps were adorned with Nazi imagery (see figure 8) and compared to the methods used by the US National Security Agency (NSA) in counter-terrorism work.

This reaction demonstrates how actors can mistrust maps, but also strategically re-frame them (in this case, as evidence of organized persecution). Maps travel and lend themselves to being used in ways that were not always intended by their makers. They are, as James Corner remarks, "not prescriptive, but infinitely promising" (1999). Being unable to fully anticipate the consequences of our mapmaking reminds us of the impossibility of keeping our hands clean. The project to map wind energy controversies was funded by the Danish Council for Strategic Research in a consortium that comprised industry partners as well as municipal developers. It was therefore reasonable to expect that any research coming out of that project could be framed as partisan. And it is important not to confuse this situation with a resignation to doing nothing of the wind industry. The overall objective of the project was to

Ch2. A proliferation of issues

The plan has dramatically turned the fortunes of the population growth. All public land has been sold and developed, with the exception of an old beach meadow on the common south of the city center. According to the original deal, this is the last plot of land to be sold to pay off the metro loans. The common is also the last place available for new home completion, protest erupts. Residents of adjacent areas, environmental activists, cultural and political personalities, and members of the local branch of the Society for Nature Conservation (SNC), coalesce in a heterogeneous opposition group under the name "Friends of the Common." Through its Facebook page, the group organizes rallies and launches petitions. Soon they succeed in mobilizing public opposition against the plan, arguing that too many green spaces have already been lost to the city's rapid expansion and that this piece of land is so unique that it should never have been targeted for development. Although the city council remains resolutely in favor of the project, the beach meadow issue could turn things upside down at the looming municipal election and pave the way for the city's first "green" political majority.

The problem is that a deal was struck 25 years earlier between all the major actors at the time. The deal protects 90 percent of the common, in return for the right to develop the beach meadow. Most of the actors who were part of that deal stand by it. But not the SNC, which signed the deal, but never really liked the idea of building on the meadow as it made clear in an op-ed published just after the conclusion of the negotiations:

The master plan, which has now been agreed upon, states that the area can be developed in 30 years at the earliest and that it must be cared for as natural land until that time. We hope that the relevant authorities will by then have gotten so much wiser that the development will never be realized. (The director and regional manager of the Society for Nature Conservation in 1995, our emphasis and translation.)

While most actors have a general opinion on whether the development should go ahead or not, in practice they do not talk much about this overall question. Instead, their discussions revolve around a set of more particular issues, such as what part of the common we are actually talking about, how valuable it is, according to which logic, etc. To get a sense of the variety of stakes in the debate, we can begin by inventorying these issues. This will force us to realize that different issues are interdependent and that rather than a flat list, the debate resembles a tree with multiple diverging and converging branches (Figure 11).

Most Copenhageners agree that the city is experiencing a rapid increase in population and

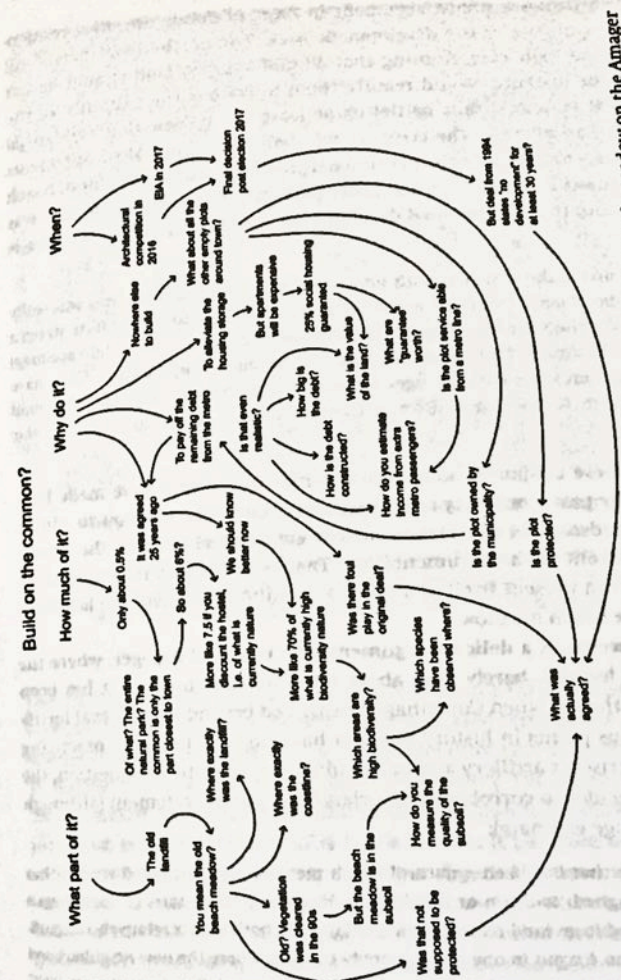


Figure 11 First attempt at inventorying the issues surrounding the plans for developing the beach meadow on the Amager Common in Copenhagen. By mapping how the overall question of whether to build on the common breaks into different sub-questions and thus leads to a range of different problems and positions, it becomes clear how issues such as nature conservation, biodiversity, housing, debt management, and urban mobility are intersecting (created by the authors; released by the authors under CC BY-SA 4.0).

Ch3. Making room for more actors

Making room for more actors

In this chapter, we learn that, when it comes to the politics of science and technology, we should not only consider decision and opinion makers, scientists and engineers, but also acknowledge the role of lay experts, appreciate the agency of non-humans, and actively seek out the position of those who have a hard time making their voices heard.

In the previous chapter, we explored different types of issues and sources of disagreement. In this chapter, we will try a similar inventory but for controversy actors. Once again, the attempt is half conceptual and half historical. It provides an inspirational but open-ended list that cartographers can use to identify the protagonists of a controversy, but it is not exhaustive. It also gives a sense of how STS has progressively extended the notion of agency (i.e., the capacity to initiate or interfere with a course of action) to a wider variety of entities. As scholars in STS were considering new types of technoscientific conflict, they were also encountering new forms of action. Issues and actors go hand in hand, to the point that it is sometimes difficult to distinguish one from the other. It is the emergence of new issues that drag new actors into the controversy, just as it is the arrival of new actors that enables new issues to be taken into account. This is exactly what happened in the controversy on the Copenhagen beach meadow that we began to follow in the vignette introducing the previous chapter. As we will see below, it took a particular breed of actors to reopen the issue of the natural value of the beach meadow.

In May 2016, a biologist surveying the eastern edge of the old beach discovers an extremely rare orchid, the *Orchis militaris*, a species that has not been seen in the country for 27 years and is now listed as extremely rare (International Union for Conservation of Nature). The finding enters the local news cycle and appears in a television segment. The controversy could not be more dramatic: the area is a protected site, and the project has been announced just a few days after the discovery. A new actor has entered the scene.

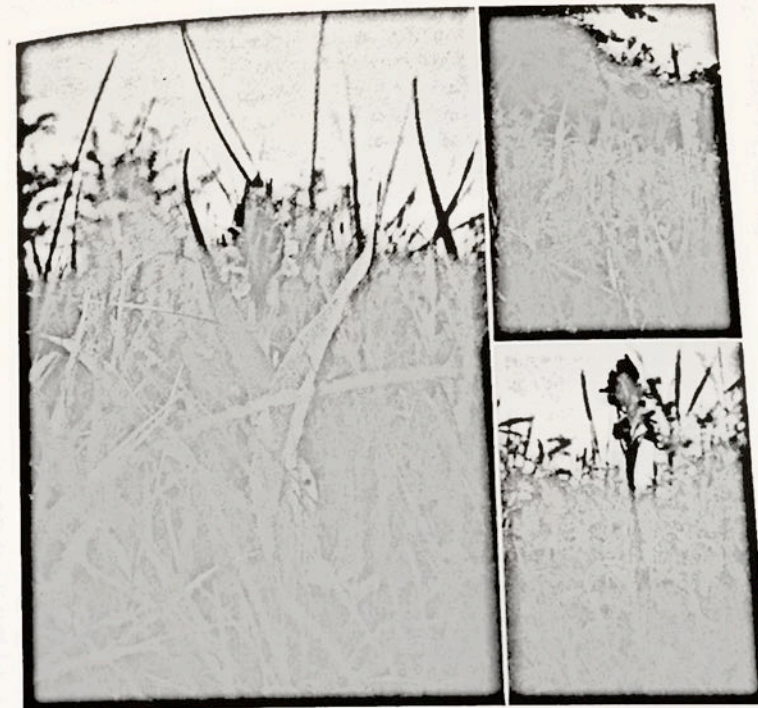


Figure 17 Screenshot of a post on the Friends of the Common Facebook group with the three red-listed orchids photographed in May 2016 on the beach meadow. The military orchid is the one on the bottom-right (original photos by Lars Andersen).

obvious that the controversy has changed, it is not easy to say who produced the change and how. Rare orchids, of course, do not intervene in the controversy on their own. They need botanists to identify them and document their presence. They need organizations like the IUCN to evaluate how rare and endangered they are. They need directives and regulations that impose legal consequences on those who would disturb their precarious situation. And they need a level of public attention that will get them on TV when they show up after 27 years of absence. It is not just one actor who has entered the scene, then, but a whole set of characters. The new character is the expert, namely the biologist from the University

geographical groups tend to be consistently under-voiced and systematically oppressed, this should not be assumed regardless of the situation, and how they have voiceless should always of the situation, as if it was an innate quality. The controversy on colonial curricula (Luckett, 2016), i.e., on the Eurocentric focus of the literature taught in higher education, is illustrative here. In a sense, it is very explicitly about giving voice to the voiceless: a course in South American politics that ignores indigenous scholars is part of a sociotechnical arrangement that subjugates native enous scholars is part of a sociotechnical arrangement that subjugates native perspective. Yet in other situations, the question can get flipped on its head: if, for instance, the argument about colonial curricula is used by authoritarian leaders to purge their education system of unhealthy Western influences. This reconfigures who is subjugating and who is subjugated, and controversy mapping must be flexible enough to show it.

Tools of social cartography

Ch4. Exploring controversies as actor-networks



Figure 26 Cellar floor, fermentation tanks, and the dog named Terroir in Béziers (left); cellar floor, fermentation tank, and natural winemaker in Berlou (right) (photos by the author, Høyrup & Munk, 2007b).

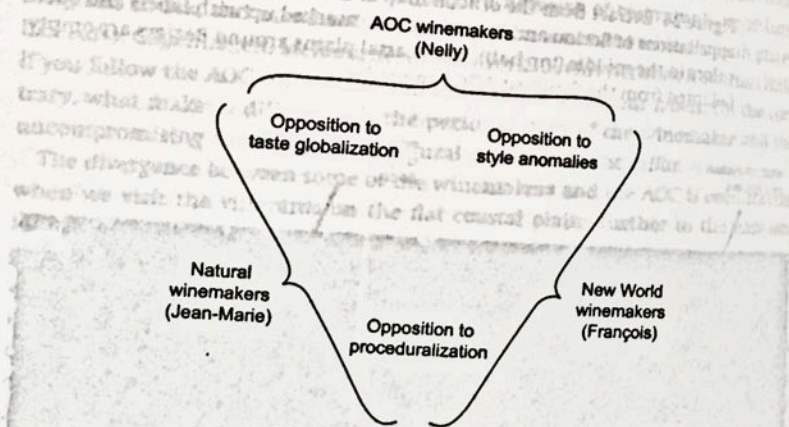


Figure 27 A semiotic triangle of French wine oppositions (created by the authors; released by the authors under CC BY-SA 4.0).

the vantage point from which they engage the controversy (see figure 27). Seen from Nelly's office at the AOC syndicate, the story of the controversy is one of terroir and tradition versus markets and blind consumer culture. The fault line is between the heritage of France and the wine industry of the New World. In this story, which resonates with the official narrative of the INAO in Paris, Jean-Marie is a winemaker with a terroir worthy of inclusion in the AOC, whereas François is an anomaly or even an enemy. On the other hand, reliance on spontaneity

exposes Jean-Marie and nature (seen as an opportunity) of producing wines that fall outside the expectations of established French precision ("justesse") – a risk that is unacceptable for both Nelly and François.

Seen from the point of view of Jean-Marie in the slate hills of Berlou, natural winemaking diverges from the AOC because of the refusal to define quality in the respect of some standard procedures. In this sense, Jean-Marie can see in François an ally against the institutionalization of quality that the AOC embodies. On the other hand, both François and the AOC represent a highly controlled style of winemaking where no room is left for nature and spontaneity.

Finally, seen from the point of view of François, Jean-Marie might be an ally in opposing the rules of the AOC and making space for alternative definitions of quality in winemaking, but he is certainly not an ally in terms of how wine should taste. In fact, if François could agree on one thing with Nelly at the AOC syndicate, it would be that Jean-Marie's unheated fermentation tanks will fail to deliver a "correct" product. Despite his antipathy towards regulations, François still subscribes to a conventional definition of when fermented grape juice can legitimately be called wine, a definition which excludes many natural wines, or at least categorizes them as "defective," as François and Nelly would concur.

Following actions with ethnography

To be able to follow a multitude of issues and actors, and to do so from a variety of perspectives, controversy mapping and ANT need flexible means of observation: "a way of thinking about method that is broader, looser, more generous" (Law, 2004, p. 4) and capable of responding "creatively to a world that is taken to be composed of an excess of generative forces and relations" (p. 9). Such a methodological attitude is the defining feature of ethnography, which since its inception has been characterized by a radical openness to the actors' own perspectives. As John Law puts it:

Ethnography lets us see the relative messiness of practice. It looks behind the official accounts of method (which are often clean and reassuring) to try to understand the often ragged ways in which knowledge is produced. (Law, 2004, p. 19)

An urban legend in anthropology recounts how Alfred Kroeber, when asked for fieldwork advice by one of his graduate students, threw him the thickest ethnographic monograph he could find and exclaimed: "Go forth and do likewise" (Axtell, 1979). Ethnographers in the field must be capable of "thinking on their feet," not just because fieldwork is full of surprises, but especially because it involves a radical commitment to what Bronislaw Malinowski called

Ch5. Exploring controversies with digital methods

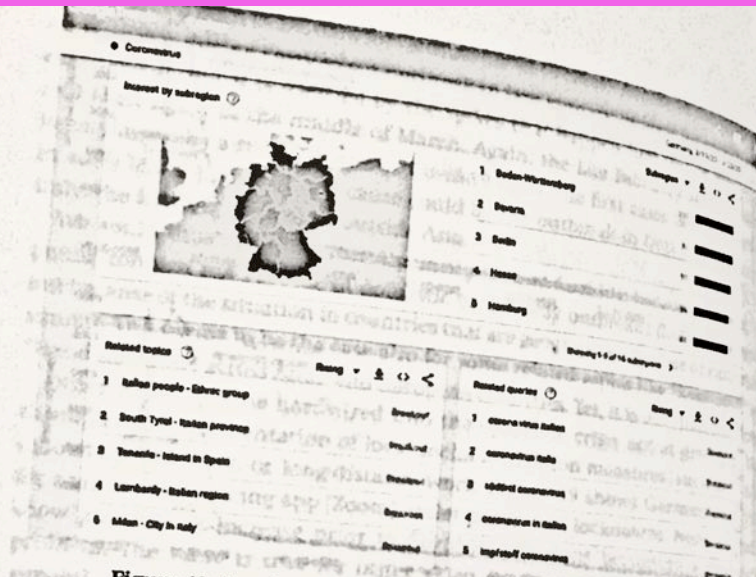


Figure 40 Search topics related to the topic "Coronavirus" in Germany between February 19 and 25, 2020 (data source: screenshot from Google Trends, <https://www.google.com/trends>).

in aggregation, that is in approaches that focus on specific observables (e.g., not individuals in their full complexity, but their age or income class) and track them to reveal general patterns and regularities. For example, when bibliometricians measure academic production, they focus on number of publications, citations and impact factors, deliberately disregarding all other dimensions of academic success.

The theoretical partition between micro and macro phenomena, discussed at the end of the previous chapter, is thus matched by a methodological partition between situated and aggregative research – a separation often referred to as the “quali/quantitative divide.” This divide is so deep-seated that a scientometrics study by Traag and Franssen (2016) revealed that it has become the most prevalent discursive distinction in the social sciences. By extracting the noun phrases appearing in the 14,613 articles published between 2010 and 2015 in the journals categorized under “Sociology” by the Web of Science and plotting their co-occurrence, the authors obtained a network displaying a clear divide between a literature centered on “practices,” “case studies,” “discourse,” “meaning” and another privileging “data,” “surveys,” “rates,” and “analysis” (see figure 41).

In their respective spheres (namely local situations and society-)

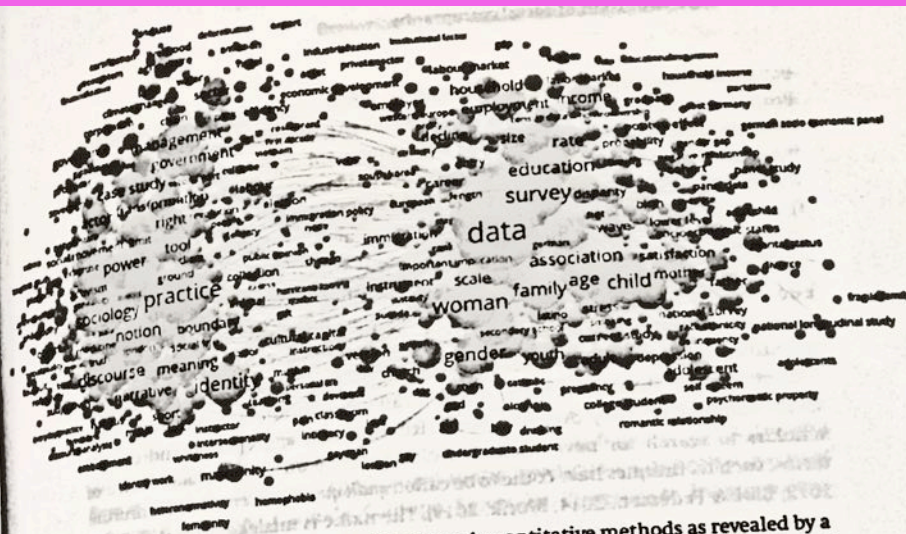


Figure 41 The divide between qualitative and quantitative methods as revealed by a visual network analysis of noun phrases co-occurring in sociological articles (Traag & Franssen, 2016). Qualitative methods on the left, quantitative methods on the right.

both qualitative and quantitative methods are perfectly productive. They allow researchers to engage in depth with specific interactions without getting lost in the tangle of influences surrounding them; and to "look at the big picture" without bothering about single brushstrokes. Yet, convenient and established as it may be, the quali/quantitative divide only works as long as local situations are effectively shielded from the larger network of influences (such as when scientific activities are protected by the material and institutional walls of the laboratory) and when global structures are underpinned by a potent aggregation apparatus (such as when states guarantee electoral statistics).

Controversies, alas, are precisely the moments when the separation between global and local phenomena is called most brutally into question. In controversies, nothing resembles a situated interaction because actors are constantly invoking or complaining about the external influences interfering with their local action; and nothing resembles a collective structure because no aggregation holds in the shifting game of alliances and oppositions. Where disputes rage, where actors cannot come to agreement, where social ties come undone or where change unfolds so quickly that old institutions dissolve before new ones are created, quantitative and qualitative methods reach their limits. Qualitative researchers will often insist that the actors in sociotechnical debates are desperate to be counted and counted differently, Gray et al., 2016). Parents of children suffering from a neurological disorder will fight to have their diagnoses

Ch6. Collecting and curating digital records

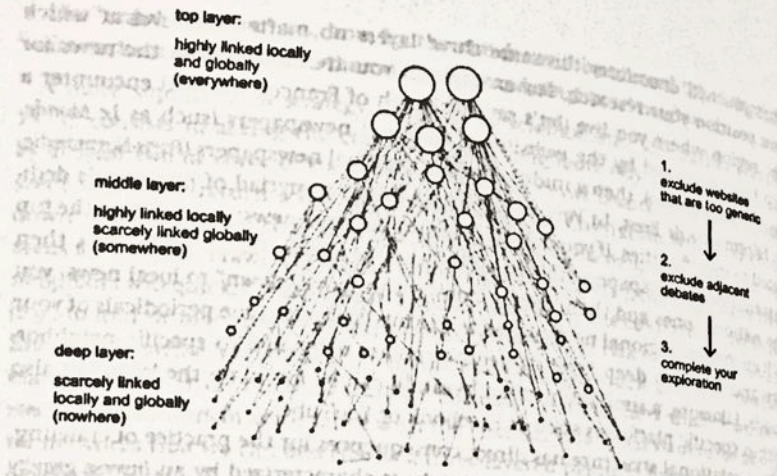


Figure 56 The three-layered model of online connectivity and the three-step crawling protocol developed by Mathieu Jacomy and Frank Ghitalla.

& Shorish, 2014). Culinary sites are more inclined to cite other culinary sites (or indeed other culinary sites with similar interests, Munk & Ellern, 2015); blogs typically cite other blogs; right-wing pages pay more attention to conservative pages (Adamic & Glance, 2005); French-speakers prefer to associate with fellow Francophones. The specific type of resemblance is less important than the fact that these similarities are mutual and that websites that receive a link also tend to *link back*. This backlinking is not always direct and yet it typically remains in the same vicinity: not all blogs cited by your fly-fishing blog will reciprocate, but they will still link to similar websites, some of which will eventually cite your blog. It is because of this communal attachment that the fabric of the Web does not extend seamlessly, but is organized in clusters gathering websites with similar connections, "friends of friends" so to speak (cf. Gibson et al., 1998; Flake et al., 2002; Roth & Cointet, 2010).

The second dynamic of online association, preferential attachment, means that websites that are already highly cited have a higher probability of attracting new hyperlinks. Preferential attachment is the reason why, despite its vast dimensions, the World Wide Web can be traversed in a few clicks (just 19 according to Albert et al., 1999). With one click from a Madonna retrospective of your favorite vintage music blog, you can be redirected to the Wikipedia page of the 1980s pop star and, a click later, find yourself contemplating the question of Christian symbolism. This experience of virtual teleportation is possible because, while most websites are associated with a small number of other web-

such as Wikipedia, Facebook, or Reddit, have millions of contacts spanning from and to distant online spheres. It is because of these sites that the diameter of the Web is so surprisingly small and information can spread so fast across it (Barabási, 2002).

Preferential attachment is not limited to digital networks and was in fact first observed by social network analysts. In the late 1960s, the American psychologist Stanley Milgram organized an unusual experiment. Milgram asked random people from remote cities in the US to dispatch a letter to another random citizen. The subjects were instructed as follows: "if you do not know the target person on a personal basis, do not try to contact him directly. Instead, mail this folder ... to a personal acquaintance who is more likely than you to know the target person" (1967, p. 64). To Milgram's surprise, most letters reached their destination in six or less steps (hence the popular idea of the "six degrees of separation" between any two persons in the world). Milgram explained this result through geometric progression: even if every individual knows only 100 persons, through six degrees of separation the message can potentially spread to billions of people (100⁶ to be precise).

In reality, however, the overlap of social circles lowers the magnitude of Milgram's progression significantly. While every person can have several acquaintances, each of which can have several acquaintances as well, for people in the same social circle most of these acquaintances will be the same. In highly clustered networks (where friends of my friends tend to be my friends too), the progression of new connections is not geometric but much slower. Thirty years after Milgram's experiment, Duncan Watts and Steven Strogatz (1998) demonstrated that small world structures emerge not because of geometric progression but because of network shortcuts. Even if the majority of connections remain in the vicinity of their source, the existence of a few heterogeneous associations can dramatically shorten the network diameter (see figure 57). It is not because people had many close friends that they could efficiently dispatch Milgram's letters, but because they had a handful of distant acquaintances (in line with the importance of "weak ties" described by Mark Granovetter, 1973, 1983).

In statistics, a "normal distribution" (also called the Gaussian distribution or bell curve) is one where most values gather around the arithmetic mean, which therefore defines the characteristic scale of the phenomenon (see figure 58, left). For example, the height of a human population is defined by its average because most individuals are close to that average, with only a few being much taller or shorter. While many natural and social variables follow this distribution, some are distinctively different. At the beginning of the twentieth century, the Italian economist Vilfredo Pareto noted, for example, that wealth does not distribute around the average. Instead,

Ch7. Visual Network Analysis

able is the same operation (Venturini et al., 2020).

Structural holes, clusters, and sub-clusters

To explore the relational organization of this Green Revolution network, we start by positioning the nodes in a two-dimensional space using the software Gephi and the layout algorithm ForceAtlas2 (Jacomy et al., 2014). This layout algorithm works by drawing nodes that are directly or indirectly connected closer together and thereby highlights regions where numerous nodes are tightly connected and regions that are empty or almost empty. Sometimes, network regions have clear boundaries, like the cliffs separating a plateau from a valley, but most of the time their borders are gradual, like the slopes of a mountain. The fuzziness of these regions does not prevent us from recognizing them: a mountain can be distinguished from a plain even if it is impossible to say exactly where one starts and the other ends. Also, most networks initially appear as shapeless hairballs of points and lines and it is only by testing different layout algorithms and parameters that differences in relational density can be perceived.

To highlight these differences, we can place our network on a background representing its density heatmap (see figure 62, top). This helps us recognize the emptier zones of the graph, the so-called "structural holes" (Burt, 1995) – in the image their position is roughly indicated by two dotted lines. From the appreciation of structural holes, we can move to the identification of the denser zones of the network. In figure 62, bottom, we have highlighted the main clusters (dotted gray) and the smaller sub-clusters (white with black borders). Clusters and sub-clusters have been manually labeled and about a half of the node labels have been removed to increase legibility.

The main divide of the network separates the pages dedicated to discussions about "agriculture" (on the left in both renderings in figure 62) from those dedicated to "genetics" (on the right). This divide corresponds to the two main controversies related to the Green Revolution: the effect of agricultural modernization on land management, food production, and the scientific improvement of plant biology. On both sides, we can then observe a secondary divide between the questions more directly connected to humans at the top ("C. Land rights" on the left and "D. Evolutionary genetics" on the right) and the questions more connected to the environment at the bottom ("A. Agricultural systems" on the left and "B. Genetic conservation" on the right).

The lower part of the graph is significantly more populated than the upper part and its two clusters can be divided into several sub-clusters. The identification

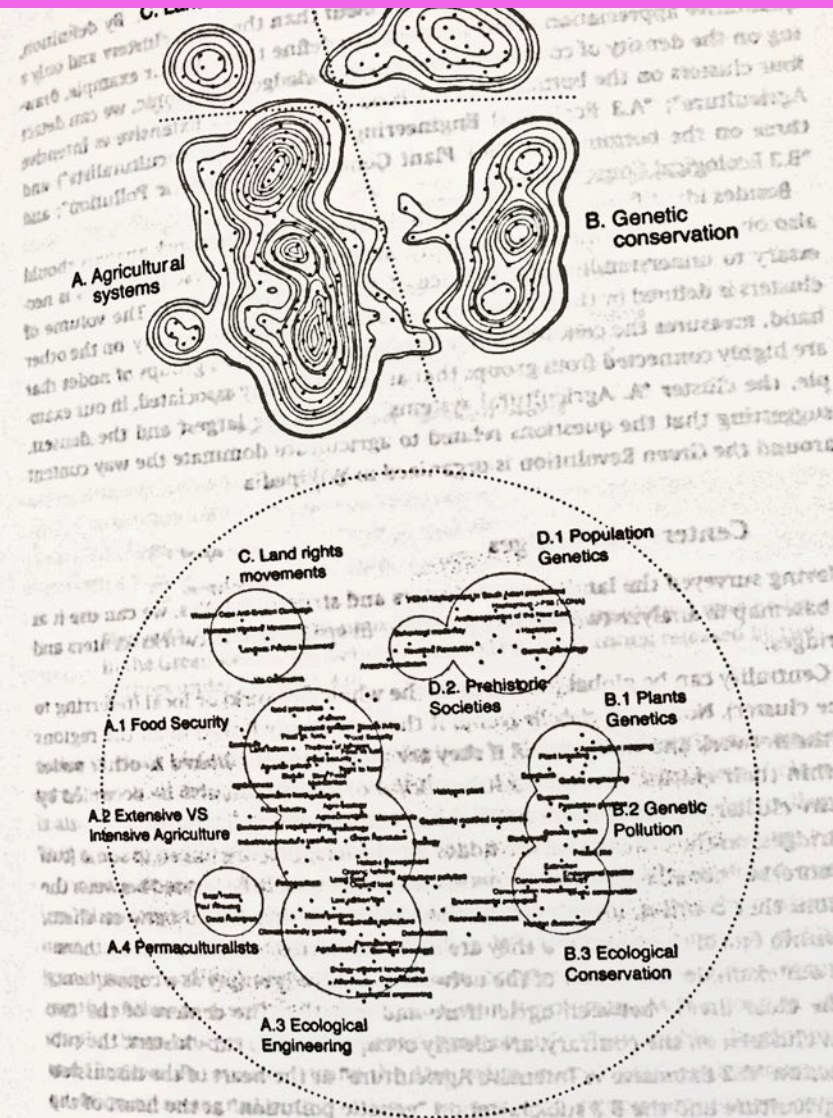


Figure 62 Two renderings of a network of Wikipedia pages related to the Green Revolution. Top, density heatmap and structural holes; bottom, clusters and sub-clusters (created by the authors; released by the authors under CC BY-SA 4.0).

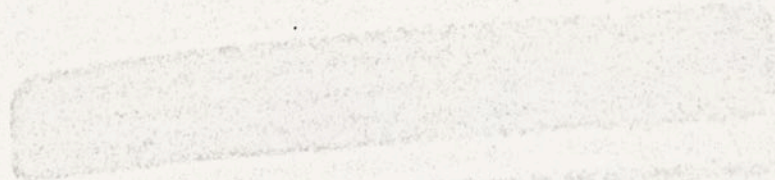
Part Three: Politics of mapmaking

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Part Two: Tools of social cartography

ones. Controversies are tectonic forces that break and transform the shape of social territories. They make and remake space (Massey, 2005). As a consequence, social cartographers can never simply project the trace of a new debate on a standard map of the collective space, but are forced to rebuild their "base map" at each case study.

Part Three: CONTROVERSY Politics of mapmaking



The relevance of social network analysis to cartography in the context of the question of the attribution to not only cartographers the responsibility of the social sciences, but made it possible to question the traditional view of cartography as a reflection of a consensus on the same place. This is the case of the map of the city of London, a work of cartography in which the cartographer's role is not only to represent the city, but also to shape it, especially with the drawing of new lines, redefining the city's boundaries and especially with the drawing of new lines, redefining the city's boundaries and especially with the drawing of new lines, redefining the city's boundaries.

In October 2013, we were invited to make a contribution to the 10th Global Forum on Artificial Intelligence for Humanity (GFAI) in London. The forum was the first of its kind, and it was a great opportunity to discuss the role of artificial intelligence in the future of humanity. The forum was organized by the British Academy and the Royal Society, and it was a great opportunity to discuss the role of artificial intelligence in the future of humanity. The forum was organized by the British Academy and the Royal Society, and it was a great opportunity to discuss the role of artificial intelligence in the future of humanity.

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Ch8. Representing controversies

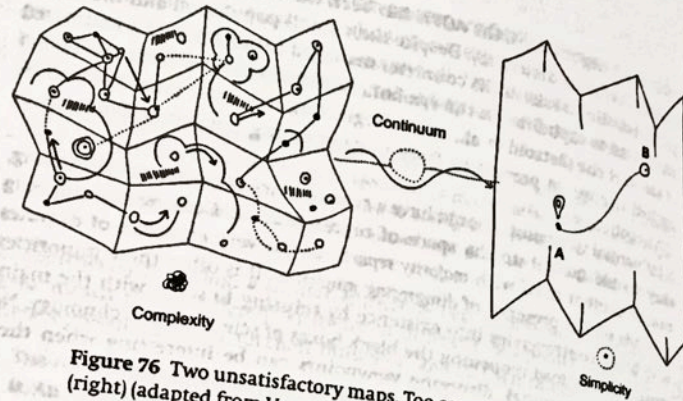


Figure 76 Two unsatisfactory maps. Too complex (left) and too simplified (right) (adapted from Venturini et al., 2015c).

This is the contradiction famously illustrated by Luis Borges and, before him, by Lewis Carroll:

- "What do you consider the largest map that would be really useful?"
- "About six inches to the mile."
- "Only six inches!" exclaimed Mein Herr. "We very soon got to six yards to the mile. Then we tried a hundred yards to the mile. And then came the grandest idea of all! We actually made a map of the country, on the scale of a mile to the mile!"
- "Have you used it much?" I enquired.
- "It has never been spread out, yet," said Mein Herr: "the farmers objected: they said it would cover the whole country, and shut out the sunlight! So we now use the country itself, as its own map, and I assure you it does nearly as well."

Lewis Carroll, *Sylvie and Bruno Concluded*, 1893

The Cartographers Guilds struck a Map of the Empire whose size was that of the Empire, and which coincided point for point with it. The following Generations, who were not so fond of the Study of Cartography as their Forebears had been, saw that that vast Map was Useless, and not without some Pitilessness was it, that they delivered it up to the Inclemencies of Sun and Winters.

George Luis Borges, *Of the Exactitude in Science*, 1946

The trade-off between richness and legibility, however, can give impetus to the cartographic effort if, instead of asking where to stand on the legibility/complexity spectrum, we ask how to move through it. Framed as a question of process, the contradiction can be "unpacked" and dealt with through two separate "moves." The first multiplies the representation of the controversies and replaces maps with atlases. The second allows the reader to shift between narra-

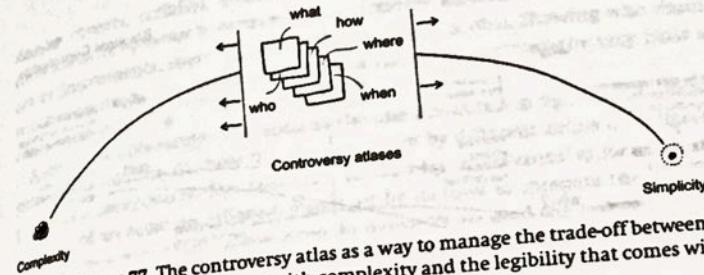


Figure 77 The controversy atlas as a way to manage the trade-off between the richness that comes with complexity and the legibility that comes with simplification (adapted from Venturini et al., 2015c).

tion and exploration in a movement of datascape navigation.

In chapter 3, we said with Donna Haraway that there is no such thing as a view from nowhere, no location from which to gaze at everything at once. Such a panoptical map would have to be many times the size of its territory and would be folded onto itself in all sorts of ways. Controversies are ontologically multiple: they exist in a pluriverse that, by definition, cannot be mapped at once. What is needed, therefore, is not an impossibly exhaustive map but a multitude of partial maps. Not a controversy map, but a controversy atlas (see figure 77).

What sort of maps should be collected in a controversy atlas depends largely on the dispute under investigation. In some cases, the most important aspect is the evolution of the debate and a chronological sequence should therefore be central. In other cases, the balance of forces is key and a representation of the opposing alliance is more relevant. The only way to respect the specificity of each controversy is to match it with a series of *ad hoc* representations. The best we can do is to list a few types of maps we have encountered in our practice. In fact, you have encountered them too, as we used them in the introduction to describe the controversy about the elephants of the Amboseli National Park.

The first type of map is meant to show that statements are never isolated but emerge in arguments between actors. It is therefore crucial to be able to show how different discourses question and respond to each other. Among the many ways to do so, a classic solution is the Porphyrian tree. Showing how questions and answers branch and connect, the "tree of disagreements" makes it evident that controversies are much richer than binary oppositions.

A branching tree such as the one in figure 78 does a fair job in conveying the multiplicity of the controversy. It shows how every question asked in the debate produces a cascade of additional questions and answers. This interrogative structure complicates the main opposition

Ch8. Mapmaking as a form of intervention

These institutional arrangements have restored public trust in science as their promoter had hoped for, perhaps because they still implicitly envisioned the public through the "deficit model": the public lacks knowledge and expertise and is waiting to be enlightened. One more troubling concern perhaps, is that these institutions could be considered less as a tool for helping the public participate in the governance of science, than as a tool for governing the public's anxieties about science, while leaving the general course of scientific research unaltered. (Strasser et al., 2019)

According to Michel Callon (1999a), public engagement with technoscience comes in three basic varieties. The "public education model" is premised on the idea of a public deficit of knowledge and assigns to the scientists the task of facilitating the transmission of information. The "public debate model" acknowledges the stakes of the public in the production of knowledge and accepts a need to keep scientific claims open to commentary from those affected by their consequences. Finally, the "co-production of knowledge model" assumes that scientific activities should be pursued in a constant and genuine dialogue with their publics. Controversy mapping falls in the last category and, in line with its intellectual origins, it proposes as sort of *open-air* experiment shared between the observer and the observed. From STS, controversy mapping derives the idea that researchers should facilitate public involvement in technoscientific projects (Jensen, 2012) and raise questions about trust (Wynne, 2006), the role of experts (Nowotny, 2003), the democratization of knowledge (Stengers, 1997, 2000), and the viability of technological fixes (Woolgar, 1990; Brandt, 2006; Hyysalo, 2006; Ehn, 2008; Petersen & Munk, 2013). From ethnomethodology and ANT, it inherits the commitment to describe collective situations throughout the methods developed by their protagonists and to co-build its inquiry with anyone or anything that participates in the situation or feels concerned by its consequences (Dewey, 1938, 1946). Ultimately, however, the stronger push to openness comes from the fact that controversies themselves cannot be contained in institutional spaces because they are precisely the moments when sociotechnical black boxes are prised open and existing framings overflowed by the appearance of new actors or new alliances.

Data sprints

The radical openness of controversies means that their mapping invariably begins with a blurred appreciation of their features and an unsure definition of their actors. This is why the political engagement proposed by controversy mapping is always shaped like a spiral (see figure 87). It starts from reaching out for a *non-representative* sample of actors, asking them wrong questions, and obtaining disappointing answers. It continues, mistake after mistake, by improving the number and the quality of informants, enhancing relations with them, and



Figure 87 The spiral of public participation (adapted from Venturini et al., 2015c).

producing better and better maps. It ends by co-designing a number of diagrams with a heterogeneous group of coinvestigators.

Setting up such a spiral of public participation requires a profound transformation of research practices. Sticking to a conventional protocol that lines up research questions, performs data collection, analysis, visualization, and eventually disseminates results is no good for controversy mapping as a form of democratic participation. What we need instead are research formats allowing us to fail and improve our research iteratively and together with those who have a stake in it. One of these formats can be found in the tradition of participatory design (Björgvinsson et al., 2010, 2012) and open-source development (Abrahamsson et al., 2003; Conboy, 2009). In an influential chronicle of the development of Linux, the celebrated open-source operating system, Eric Raymond described this approach by contrasting the construction of cathedrals to self-organization of bazaars.

Linus Torvalds's style of development – release early and often, delegate everything you can, be open to the point of promiscuity – came as a surprise. No quiet, reverent cathedral-building here – rather, the Linux community seemed to resemble a great babbling bazaar of differing agendas and approaches (aptly symbolized by the Linux archive sites, who'd take submissions from anyone) out of which a coherent and stable system could seemingly emerge only by a succession of miracles. (Raymond, 1999, pp. 21-2)

Faced with such uncertainty, how their projects will develop and who will win (a condition that closely resembles that of controversy

Controversy mapping in the shadow of Gaia

Controversy mapping in the shadow of Gaia

In 1957, an earth-born object made by man [the Sputnik satellite] was launched into the universe, where for some weeks it circled the earth according to the same laws of gravitation that swing and keep in motion the celestial bodies – the sun, the moon, and the stars ... The immediate reaction, expressed on the spur of the moment, was relief about the first "step toward escape from men's imprisonment to the earth."

... The banality of the statement should not make us overlook how extraordinary in fact it was; for although Christians have spoken of the earth as a vale of tears and philosophers have looked upon their body as a prison of mind or soul, nobody in the history of mankind has ever conceived of the earth as a prison for men's bodies or shown such eagerness to go literally from here to the moon. Should the emancipation and secularization of the modern age, which began with a turning-away, not necessarily from God, but from a god who was the Father of men in heaven, end with an even more fateful repudiation of an Earth who was the Mother of all living creatures under the sky?

... There is no reason to doubt our abilities to accomplish such an exchange, just as there is no reason to doubt our present ability to destroy all organic life on earth. The question is only whether we wish to use our new scientific and technical knowledge in this direction, and this question cannot be decided by scientific means; it is a political question of the first order and therefore can hardly be left to the decision of professional scientists or professional politicians.
(Arendt, 1958, prologue to *The Human Condition*)

Hannah Arendt's prophecy encapsulates the rationale of this field guide. It describes modernity as the condition of living in a world that has become too small for contemporary technoscience. As Marshall McLuhan observed, "the extreme form of this implosion or contraction is the image of the astronaut locked into his wee bit of wraparound space. Far from enlarging our world, he is announcing its contraction to village size" (1964, p. 295). Arendt's quote also contends that taking care of such an environmental crisis is a political rather than a scientific problem. Controversy mapping has in a certain sense been developed to deal with this problem or, more precisely, with the multiplicity of issues deriving from the impossibility of modern society dumping the unwanted consequences of its actions (and the conflicts that they produce) in an external environment where they can be forgotten about. Each of the controversies discussed in this book is unique but they all have their root in the same planetary *Zeitgeist*.

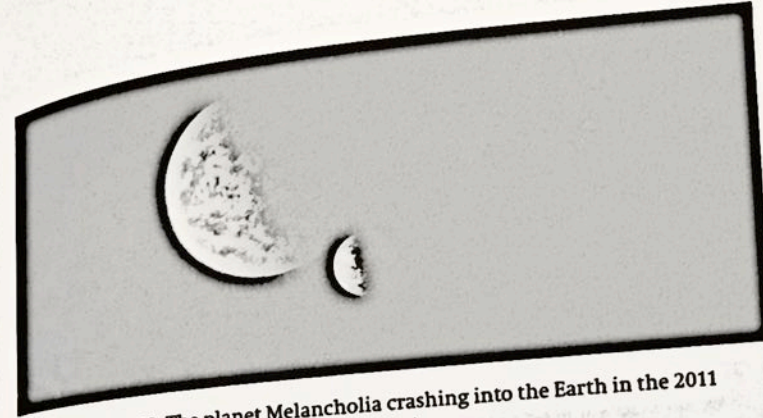


Figure 88 The planet Melancholia crashing into the Earth in the 2011 movie by Lars von Trier (photo: Alamy).

In the opening sequence of *Melancholia* (the 2011 movie by Lars von Trier), the Earth is hit and annihilated by a giant extraterrestrial planet (figure 88). The catastrophe is met with an unsettling sense of paralysis. Eyes turned to the planet *Melancholia* filling the sky, the characters move in slow motion, terrified yet incapable of acting (while, of course, continuing to disagree on whether the planet will or will not hit the Earth). A perfect metaphor for the twenty-first-century predicament. After decades in which they thought they had finally mastered their world, humans find themselves helpless in the shadow of a planetary catastrophe. While this is not the first ecological collapse faced by humanity (see Diamond, 2004, for quite a few others), it is unprecedented in the way in which it reveals the deadlock of modernity. Like the characters in *Melancholia*, we observe the hazard facing us but remain incapable of acting on it. This paralysis represents a deep rationale for controversy mapping. To understand it, we need to go back to the way in which modernity has always framed the relationship between society and its environment.

Arguably, the modern way to deal with natural hazards saw the light of day in 1755, in the wake of the great Lisbon earthquake. After what is often referred to as the first modern disaster, the philosopher Jean-Jacques Rousseau contested the framing of what happened as a fact of nature or an act of God. Had the houses been built differently, had the population been spread more evenly, had there been a proper evacuation rather than a chaotic escape to the harbor where the subsequent tsunami wreaked havoc, topped off by a devastating fire, much of the loss could have been avoided, he argued. What emerged in the aftermath of the Lisbon quake was the idea that humans, through their skill and ingenuity, can anticipate and manage natural hazards.

In the following two centuries, a combination of scientific achievements and