DRS2016
Design + Research + Society
Future-Focused Thinking

2016 Design Research Society
50th Anniversary Conference
27-30 June 2016, Brighton, UK

Designing diagrams for social issues

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Abstract: Emerging approaches in social sciences and new media studies involve inquiry into social issues via the web. By collecting, analysing and visualising digital traces (i.e. posts, tweets, comments), a "issue map" can be created in order to make visible and understandable the network of the actors involved and their position in any public debate. Drawing on experiences gathered during a European project, we identified a two-phases-approach for the creation of issue maps. In the two phases - exploration and communication - visualisations play a key role, with two different connotations: in the first, they act as analytical devices used by researchers. In the second, they become communicative artefacts for a larger public. In this paper, we describe how we defined this approach, outlining the theoretical background and its connections with communication design. We highlight the main criticalities found in designing the issue maps before finally presenting our results.

Keywords: Communication design, information visualisation, issue mapping, controversy mapping, digital methods.

1. Introduction

Due to the digital takeover, the web is progressively shaping our images of society. Social interactions, news, and documents (official and unofficial) are increasingly archived online (Dougherty et al., 2010). Public issues and concerns are aired on the web while involved actors leave digital traces of the debate every day, allowing the observation of such issues in the making (Venturini, 2012). At the same time, several biases affect this medium: not all the world's population has equal access to it, not all debates are public, and the loudness of the involved actors can be amplified or weakened by the web as a medium.

If these conditions make the web an unsuitable source for understanding a social issue, they also make it the perfect site for examining public discussion. On the web, it is possible to identify the most active actors, their factions and fractures, and how their relationships change over time.

Social sciences and new media studies have developed a theoretical approach that observes the Web as a discussion space that can be mapped and used to understand social issues. On one side, an applied version of actor-network theory, controversy mapping, identifies what social scientists should look for: controversies (Venturini, 2008). On the other hand, digital

methods, developed in new media studies, provides direction on how controversies should be investigated (Rogers, 2013).

A metaphor can assist in understanding this paradigm: the social scientist has become a cartographer who explores and describes the territory of the debate. The outputs of these studies are therefore maps and atlases that can be shared with the involved actors to understand their respective positions in debates. Interestingly, these actors may not always have the background knowledge to understand and explore such atlases. There is a demand for new visual languages capable of expressing the complexity of these studies, a demand requiring communication design expertise, particularly from the information visualisation field. Diagrams are powerful tools for expressing different layers of information, allowing a formalisation of results while simultaneously providing a seamless exploration of them, from the macro to the micro view. Researchers have already discussed the relevance of communication design in this framework at a theoretical level (Ricci, 2010) and by means of case studies; however, it has never been tested widely in a full-scale controversy mapping project.

The paper discusses the synergy between Controversy Mapping, Digital Methods and Communication design in the development of a design approach to issue mapping. The European project EMAPS provided the context to identify and test such approach. In the next sections we will provide the background knowledge needed to understand what issue mapping is and how it works.

2. Controversy Mapping

Among all of the information on the web, we need to determine which to focus on. As we stated, the web is an unsuitable source to understand a given issue, but it is helpful in understanding public debates around it. Controversy Mapping (CM) adopts this approach for inquiry into social issues by identifying a controversy and examining the arising debate. In this context, the definition of controversy is quite broad: “Controversies begin when actors discover that they cannot ignore each other and controversies end when actors manage to work out a solid compromise to live together” (Venturini, 2010, p. 261).

Controversies exist as phenomena that force actors to take a public position on an issue, therefore leaving traces about their statements, alliances and oppositions. Collecting these traces makes it possible to map the involved actors and their positioning in relation to the debate. In the reference literature, CM is presented as a “collection of techniques to observe and describe social issues developed by Bruno Latour as an applied version of actor-network theory” (Venturini, 2008, p. 1). Originally developed for teaching actor-network theory to college students, it evolved into a full research methodology.

The cartographic metaphor originates within CM: the social scientist is a “social cartographer” whose aim is to explore the controversial territory, analyse its morphology from different points of view and represent it by map or atlas. The metaphor also implies

that the cartographers are not outside of the object of analysis; rather, they are surrounded by it. It is impossible for them to see the whole picture of the phenomenon: they can only rebuild it by synthesising and simplifying it.

3. Digital Methods

In early studies of the web, analyses focused on its role as a new kind of society: a virtual world detached from the real one (Wellman, 2004). With the evolution of the medium, this idea became outdated: studies indicated a mutual influence between social phenomena and the web (Ginsberg et al., 2009). Gradually, this research made apparent the lack of distinction between what we can call "real" and "virtual". New methods are therefore required, methods capable of exploiting the digital nature of the web. Among the authors working on this topic, Rogers has contributed studies relevant to this research. In 2007, he coined the term "digital methods" (DMs) to describe social research methods grounded in this medium (Rogers, 2009a, 2013).

DMs are based on the recognition of biases affecting the web. Instead of trying to reduce such biases, DMs embrace them, using them as an advantage. The approach started from a simple question: how can we do social research through a medium with well-known biases? The DMs literature responds to the question by identifying "dominant devices" on the web, repurposing them for social research. From this perspective, the web is not a monolithic and coherent structure; rather, it is composed of different devices mediating our access to the underlying information. An incomplete list of devices can contain search engines (e.g., Google, Yahoo, Bing), social networks (Facebook, Twitter), collaborative environments (Wikipedia, GitHub), forums, blogs, and websites. Often, they are referred as "dominant devices", underscoring their relevance as information hubs.

Each device provides digital objects that can be used in analysis: hyperlinks, threads, tags, page ranks, and Wikipedia edits (Rogers, 2013). Depending on the analysis, digital objects can have different scales, from entire websites to single hyperlinks. An example of analysis can be seen in the repurposing of Google Search as "crown maker" (Rogers, 2009b), which analyses how the order of results varies over time for the same query. In this way, it is possible to ascertain the most influential information providers on a topic. Here, the dominant device is Google, and the digital objects are the links (the query results).

Each DMs method determines which digital objects are provided by the analysed device while identifying how they can be used for social research.

4. Designing Maps and Atlases

The exploration of issues using CM and DMs techniques necessarily passes through visual artefacts called "issue maps". As Venturini (2012) points out, the literature contains several references to visual languages:

> Exploration and representation always come together in cartography. No serious cartographer would travel a territory without taking notes, sketching plans, amending previous atlases. This is how maps have always been manufactured: through a recursive adjustment of observations and descriptions. (p. 797)

The literature describes the characteristics of a "good issue map", identifying the content that should be provided and the actions the user should be able to perform with it (Venturini & Latour, 2010; Venturini, 2012). However, the existing contributions lack a thorough discussion of how these artefacts should be designed and developed. Researchers have recognised the need for visual languages, identifying the communication design field as an ally in finding them (Latour, 2008).

The DMs literature also incorporates visual translation. Even if there is not a direct discussion on the development of such artefacts, visual translation is the only solution for representing and exploring the analyses. Visualisation is widely used in DMs where most of the tools' outputs are visual. To discuss the topic under examination, the literature often employs visualisations (Rogers, 2010) created in collaboration with designers (Rogers, 2012).

There is a strong need for visual grammars and an interaction model to present, communicate, and make understandable analyses' results. Ultimately, this situation requires communication design knowledge in the creation of "issue maps". Communication design is linked not only due to visual languages, but also to the underlying approach shared by CM and DMs of showing phenomena (the social issues) which are not clearly visible . As Giovanni Anceschi states, representing not only means making a more or less accurate replica of the visible, it also means showing the invisible. Showing the invisible, in turn, not only signifies merely illustrating the real existence, but it also means imagining visual models of the possible, probable, and hypothetical. (Anceschi, 1988, p. 59)

Other than this broad closeness to the field, the design of visual items forms the core of information visualisation:

> Visualization provides a powerful means of making sense of data. By mapping data attributes to visual properties, such as position, size, shape, and colour, visualization designers leverage perceptual skills to help users discern and interpret patterns within data. (Heer & Shneiderman, 2012, p.1).

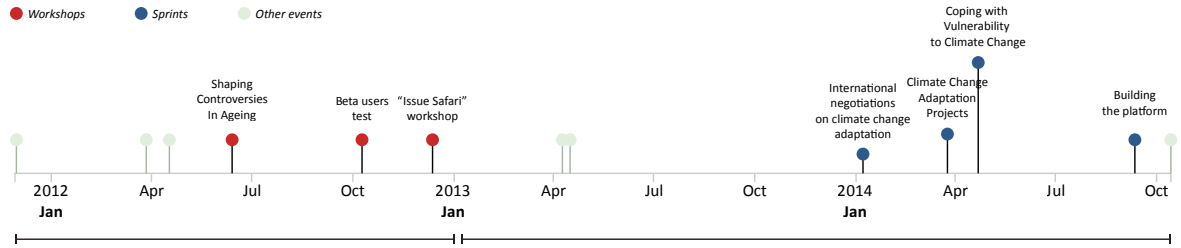
Information visualisation is not only about visual elements, but also about interaction. Proper interaction patterns are needed to move from the micro to the macro view while using the same visual layout for different data sources. Interaction techniques also support the creation of exploratory paths, providing the user a step-by-step introduction into the complexity of the analysis. Several layers of information, partially overlapping, comprise an "issue map". The resulting complexity could discourage the public from engaging with its content. Therefore, narrative techniques can present the topic to users, providing them the ability to freely explore the visualisation: "Generalising […] data stories appears to be most effective when they have constrained interaction at various checkpoints within a narrative,

allowing the user to explore the data without veering too far from the intended narrative" (Segel & Heer, 2010, p. 1147).

5. Creating Issue Maps: The EMAPS Project

The EMAPS project[1] was the first "in vivo" experimentation of CM through DMs; it directly involved communication design as a partner discipline creating the conditions to test and shape the relationship between the three competences (CM, DM and CD – Communication Design).

We have analysed, visualised and tested select topics with interested users called "issue experts", i.e. a person who is interested in the topic (e.g., climate change adaptation) but does not necessarily know the analysis methods used. The project was divided in two main phases, each one with its own case study and goals (Figure 1). The first phase aimed at identifying collaborative models and knowledge sharing within an "Ageing Population in Europe" topic. The second phase was intended to be a full-scale project seeking to explore public communication of "climate change" issues.



Phase I

Case study: Aging population in Europe

Goal: test users reactions

Issue Maps: static, printed

Duration: one year

Phase II

Case study: Climate change adaptation

Goal: create an online platform allowing the exploration of topics

Issue Maps: interactive, web-based

Duration: two years

Figure 1. Evolution of the project. The timeline reports the main events described in this paper.

6. EMAPS Part I: Static Maps and Consortium Test

In the first phase of the project, we developed "issue maps" on the "ageing population" topic, submitting them to groups of "issue experts" at different moments of the design process to identify errors and criticalities.

The ageing population phenomena assumes remarkable proportions in Europe, together with several issues and implications emerging for everyday work, social and intergenerational relationships, healthcare delivery, social services and welfare.

[1] For more information, visit the project website: http://www.emapsproject.com/blog/

The goal of the first phase was to collect users' reactions to issue maps, and as designers, we focused on the identification of suitable visual models. Three user tests were organised, each with a different sub-topic. For each one, we created an atlas of static visualisations, which we tested with users in a public workshop. The development time, number of issue maps and involved users differed for each mapping campaign (figure 2).

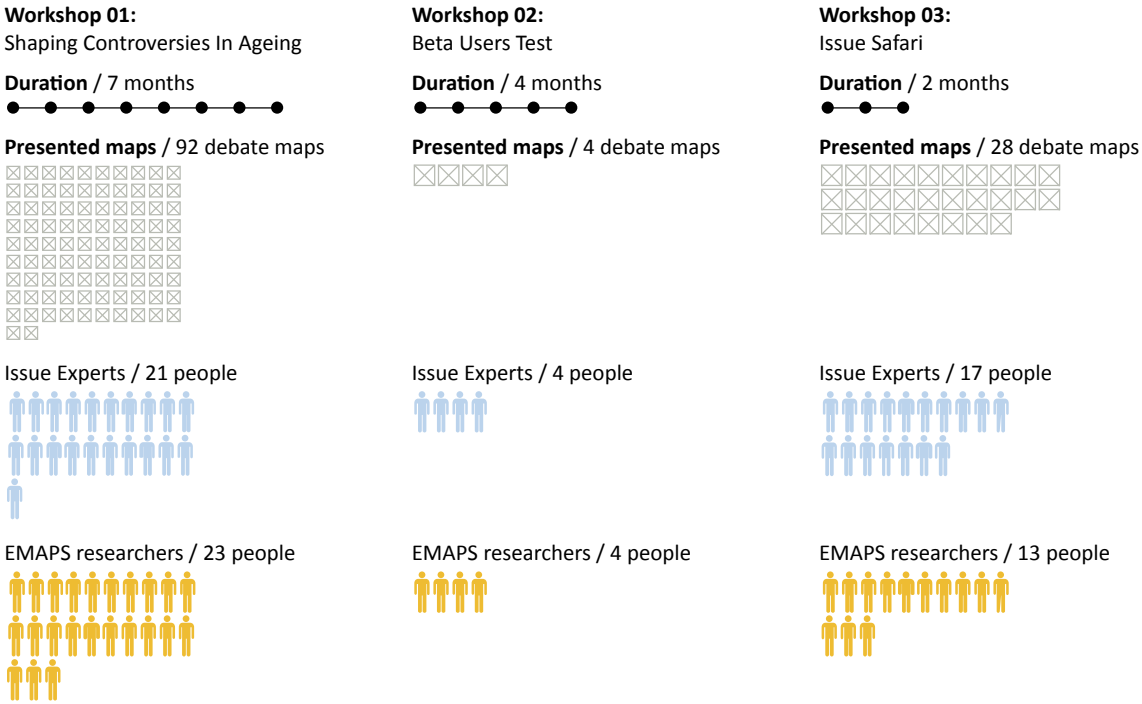


Figure 2. Diagram representing the three workshops.

Three kinds of user tests were performed. The first test involved recording users' reactions to maps when they received no prior explanation. The second test was task-based and analysed through an ethnographic approach. The third meeting also included a task-based test, where the researchers took notes on the users' ability to accomplish such tasks.

The performed tests revealed the difficulty of communicating CM results to the wider public. The major criticalities that emerged related to the visual models, analyses and methods.

From the graphic design point of view, the adoption of visual patterns that differed from standard ones (e.g., pie charts and bar charts) created comprehension issues. In fact, the users needed instruction on how to read the visualisations. The analysis methods also build upon data sources with unfamiliar structures and meanings for the users. The end users did not directly criticise the produced artefacts, but the tests were not successful. Failure was defined by users' indifference towards results, sometimes caused by their shame in admitting their inability to understand and make sense of the results. When users were able to understand the analyses, they asked for more details, therefore requiring more views on the topic and a better control over it in the movement from the macro to micro view. Better

results were obtained when the user discovered known elements in the visualisation (e.g., a person's name, an institution or a website).

We brought the emergent criticalities to a wider discussion within the consortium in order to identify new approaches to controversy and issue mapping while involving the final users in the mapping process (Venturini, Ricci, Mauri, Kimbell, & Meunier, 2015). At the same time, the workshops allowed us to identify certain criticalities specifically related to communication design. As designers, in the first phase, we focused primarily on the visual optimisation of issue maps, such as font size, labels arrangement and the use of legends. We also concentrated on creating artefacts that were correct from the data visualisation and information visualisation points of view. However, when we provided the maps to users, we noticed that difficulties in reading emerged related to design choices preceding the visual choices. One example occurred with a graph representing a web mapping (figure 3): each circle is a website discussing the ageing population, and lines represent hyperlinks between them. Many users were not aware of the meaning of a hyperlink, and some were unfamiliar with graph representations. Even though the involved researchers found the map interesting, users lacked the implicit knowledge behind the map.

Figure 3. A detail of an issue map representing links among websites talking about the ageing phenomenon. For the full issue map, visit this link: [http://bit.ly/1XigHT7.](http://bit.ly/1XigHT7)

With this map, new media scholars and social scientists were able to read the phenomenon, because they were aware of the meaning of the links and variables related to graph theory. Reading the map, they were able not only to derive findings, but also to identify errors and extract indications for further improvements.

This finding led to a second criticality: each map resulted from several operations, including fine-tuning ad-hoc solutions to improve readability. Any edit to the issue maps required a considerable amount of time.

A third criticality was that designers were the first ones unable to deeply understand the methods and sources used. Dividing the working groups according to different areas of specialisation (communication design, new media studies and social sciences), designers were provided with data resulting from the analyses, without their knowing which kind of operation was performed in the first place.

From the identified criticalities, it was therefore possible to identify three kind of users with different needs:

- the final users, who need to know the implicit knowledge behind issue maps;
- the designers, who need to know the analysis process to make explicit the choices made and their meanings; and
- the other researchers who need to improve the maps.

It became clear that it was impossible to design issue maps directly for the end users: what we produced were hybrids too complex for end users and too simple for researchers.

7. The Two Sides of Issue Maps Design

The research outcomes allowed us to identify a different approach to developing “issue maps”. The resulting artefacts can be linked back to the cartographic metaphor, with a change in meaning: social scientists, more than cartographers, are explorers. They have a destination, but they do not have a map to reach it; nor are they sure that the destination exists. Through analyses, they produce artefacts used to confirm or correct the route. Most of these outcomes accomplish their functions in the moment of their reading, instantly losing their value.

The original metaphor is based on the assumption that maps are useful artefacts for people who have never visited a certain place, and they can be drawn in the moment of exploration. By comparison, the proposal here is that the map results from two movements. The first is the exploration, annotating terrain features and confirming that the destination actually exists. It is only on the way back, however, that the explorer puts all the notes together, making it possible to create a map.

Metaphors aside, the use of the web to explore controversial issues requires two design moments (figure 4): the first to support research (the “exploration”) and the second to

encourage public communication (the "maps" creation). In these two phases, the produced artefacts play different roles.

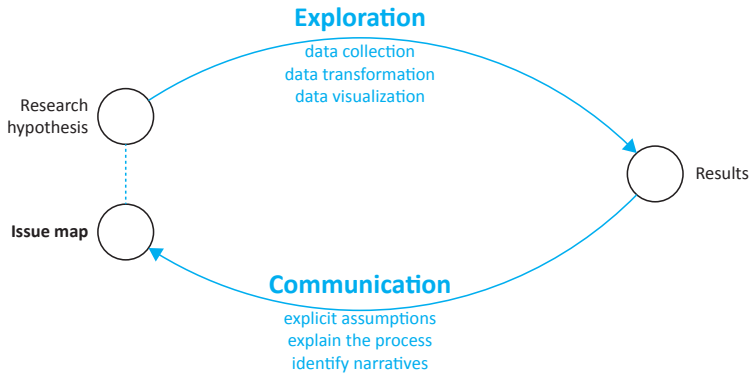


Figure 4. The two phases adopted in our workflow. In the first part, diagrams are used to inquire into the topic, while in the second part, they are used to promote results towards end users.

Issues Maps, Part One: Diagrams as Exploration

In the first part, we identified research hypotheses and performed analyses through the use of diagrams. Evaluating the processes used in the first part of the project, we found the analyses to be non-linear processes. Several diagrams were produced through transformations or actions. Here, we use the term 'diagram' in its widest sense (Valsecchi et al., 2010) to define any visual structure communicating information: from tabular datasets to static visualisations to interactive ones. Most of the produced diagrams confirm researchers' hypotheses, losing their value after reading. Diagrams therefore represent an evaluation moment: as defined in the literature, they have an epistemic role (Kirsh & Maglio, 1994). Reading a diagram, researchers are able to understand if it can be considered an end point, or if new actions are required. It is also possible to determine if there are errors and if certain actions need repeating, or if the whole process requires redesigning (figure 5). One or more artefacts compose the analysis outcome: there is not a single, finished object but multiple versions that coexist (figure 6).

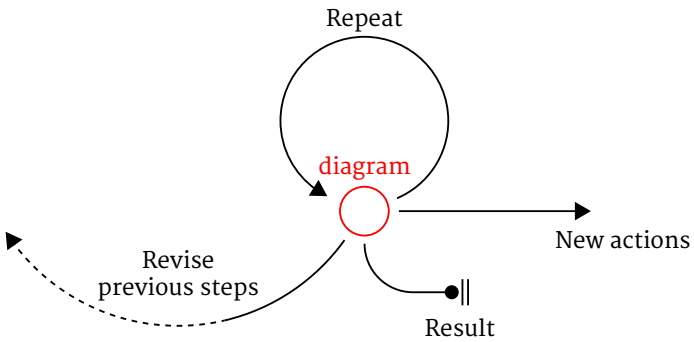


Figure 5. Diagrams as evaluation devices.

The openness to new actions is the most relevant feature of such diagrams: they are un-finished artefacts. With “un-finished”, we do not seek to refer to their nature as prototypes, or emphasise the idea that the project is not finished. Rather, with this term we want to highlight that the openness is not taken for granted; it must be designed. The ability to modify and improve is not a by-product. Instead, it is a goal that design should address in two aspects: the conceptual and the technical. From the conceptual side, it is important to consider how information is structured, keeping it understandable by allowing other researchers to modify it. The technical side involves adopting technologies, standards and frameworks that makes modification more simple.

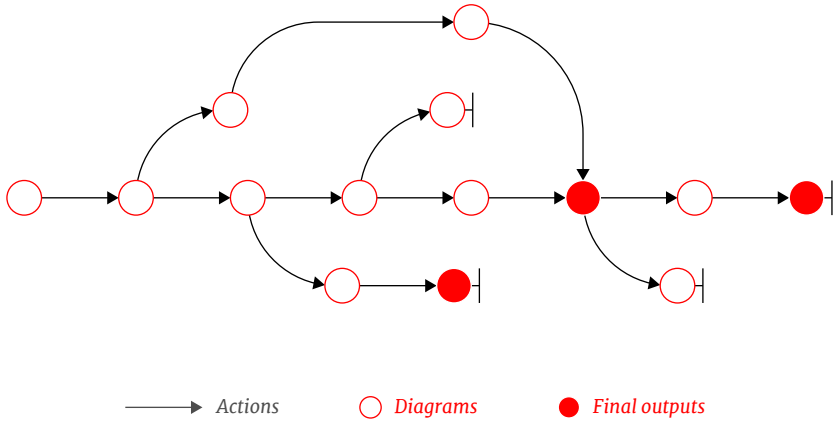


Figure 6. In the exploratory phase, the process is a chain of actions producing diagrams. Only a few of these will be considered ‘final output’ of the research.

Issues Maps, Part Two: Diagrams as Communication

After the exploratory phase, the most relevant results require a redesign in order to communicate them to the public. In this second part, diagrams play a different role: they should provide users with background knowledge in order to allow them to freely explore the results.

Reviewing the first phase of “Ageing Population”, we found difficulties in publicly communicating the results for three main reasons:

- The results are complex and difficult to read.
- The methods are experimental, and users lack all the necessary background information to understand them.
- Analyses are based on specific medium features that could be unknown to the user.

The three problems are interrelated. Communication is compromised even if just one of them is unsolved. We identified three possible approaches to overcome the described problems: design after design, trust building and interaction as co-authorship.

DESIGN AFTER DESIGN

In the previous section, we presented diagrams as tools used by researchers to understand and evaluate results. These diagrams are unsuitable for a wider public because they are based on researchers' assumptions and knowledge that does not necessarily extend to the general public. To create truly stand-alone artefacts, all of the assumptions and choices behind the analyses must be clear, an operation that can be defined as "design after design" (Bjögvinsson et al., 2012). Starting from the results, the analysis evolution is retraced, identifying all of the information needed by a user. At this point, it is possible to design a new artefact providing both results and contextual information.

TRUST BUILDING

A criticality found in the first part of the project was the users' mix of scepticism, embarrassment, and indifference. They were unable to link the presented results to something known. The problem could be divided into three questions: What am I looking at? What are its main features? Why should I trust it? While the first two questions could be solved through better use of visual models and interaction patterns, the third one requires enabling the user to follow the analysis process from the beginning to the final results. Following the analysis path, the user would therefore be able to adopt the perspective of researchers, understanding their choices.

INTERACTION AS CO-AUTHORSHIP

Finally, the interactive diagrams provided to the user should be able to convey the results as well as the information described in the two previous points. Adopting a narrative/explorative approach (Segel & Heer, 2010), the user is guided initially in the exploration during introduction of the main concepts. Gradually, more freedom to explore is given. The difference between visualisations used in the data journalism field and issue maps is that the latter are not meant to promote a specific vision of the phenomenon; rather, they provide a way to see latent behaviours and to inspire questions. Through the interaction, users should be able to define their own paths, therefore designing new research. The map cannot be flexible enough to explore every user hypothesis. In such cases, they require access to the underlying data, using it in new, unpredictable ways: the success of a diagram is defined by the moment when it is no longer useful. Once again, the solution is to keep the process open.

8. EMAPS Part II: Sprints

The second phase of the project focused on "Climate Change Adaptation". In comparison to the previous phase, the topic was intended for a more scientific audience. Scientists, academics and journalists formed the "issue experts", the primary final users of the issue maps. The goal was to create an online platform collecting interactive "issue maps".

In the first phase, one of the main criticalities was the distribution of work among institutions, causing delays and misunderstandings. Therefore, a new approach was

identified, one we called “sprint”. The method was inspired by “bar camps” and “hackathons”, born during the dotcom boom as informal moments of meeting and idea development. The sprint is a structured version of these informal meetings, fine-tuned for the social sciences. The main strength of the sprint rests in its sharp constraints:

> The short and intensive nature of these events shields them from the dream of exhaustivity often associated with ‘big data’. Participants know that they will only be able to treat a limited amount of digital traces and that they will achieve imperfect results, but they accept such constraints more as a challenge than as a weakness. (Venturini, Munk, & Meunier, 2016, p. 5)

The EMAPS project sprints were one-week events. On the first day, we invited issue experts to present their visions on the issues as well as what they would like to know. The same experts were invited for a final presentation and updated on the results during the week. Participants worked in small groups (5-6 people) composed of designers, social scientists and new media scholars. No constraints were put on the types of outcomes or on the analysis methods.

Four sprints were organised, the first three aiming to explore issues related to climate change adaptation, and the last one focusing on platform creation.

They represent the two moments of issue mapping previously described: in the first three sprints, diagrams played the role of supporting the exploratory research, while in the last one, diagrams were designed to be released as communicative and standalone results, understandable by the identified public.

Exploration: Sprints on Climate Change Adaptation

Three different institutions hosted the first three sprints, and during the events, we addressed more than 50 different research questions, developing several issue maps for each one. In the sprints, groups followed their own research paths, without needing to link the results together. We aimed to produce as many materials as possible in order to identify the most relevant one for the public communication of issues.

In the organised sprints, designers focused primarily on three tasks: identifying visual models suitable for the hypothesised analyses, structuring the collected data in order to make it useful for its visualisation, and creating diagrams. There was wide experimentation on the visual languages, testing and comparing layouts on the same data. The analysis outputs also varied in terms of their shape, ranging from static maps to interactive ones to data exploration tools. At the end of the sprint, each group was expected to collect all the source files for the designed diagrams and to describe the research protocol, making explicit the sequence of actions performed.

Communication: 'Building the Climaps Platform' Sprint

The last sprint aimed at the creation of a web platform (called Climaps[2]) featuring diagrams for "issue experts". This last sprint can be seen as the "communication" part: instead of developing new explorations, in this event, we identified the most relevant analyses produced during the previous events and redesigned them for the selected users.

Organising the sprint, we designed a structure able to address the issues found in the first part of the project, namely the need to make explicit all of the researchers' assumptions and choices, the need to provide an access point for the presented analysis, and the need to leave results open for new analyses.

It was not a suitable solution to simply collect the issue maps, even if refined and well-designed both from the interactive and visual point of view. That way, we were not providing an access point to our work at the risk of losing the users' interest.

We therefore suggested the identification of narratives where issue maps could be used to inquire into a topic. That way, users can understand a map's utility and how it works. Each working group was asked to identify two possible stories that could be explored using the issue maps. Focussing on issue maps' usefulness in exploring topics, it became simpler and clearer for everyone how to select the most relevant ones. After the second day when narratives were identified, the teams revised the selected issue maps. For each one, the development was retraced, allowing the designers to provide the users with all the needed information to interpret the maps. At the end of the sprint, the design team started to produce the final web platform.

Inspired by solutions currently used in the 'data journalism' field, we identified a simple and modular structure, featuring two kinds of elements: narratives and maps. The two are linked (figure 7), allowing the users to expand or reduce the degree of exploration in their reading.

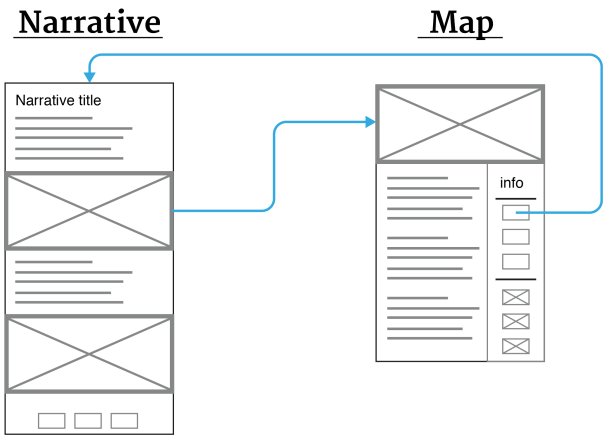


Figure 7. Schema describing links among "narrative" and "map" pages.

[2] For more information, visit the platform webpage: http://climaps.eu/

The two pages follow different structures. Within the narrative, texts and diagrams are used to form a new kind of engagement with readers/users: provided one of the multiple ways of reading issue maps, users become aware of the map's meaning and logic, enabling them to perform their own reading and interpretations (figure 8).

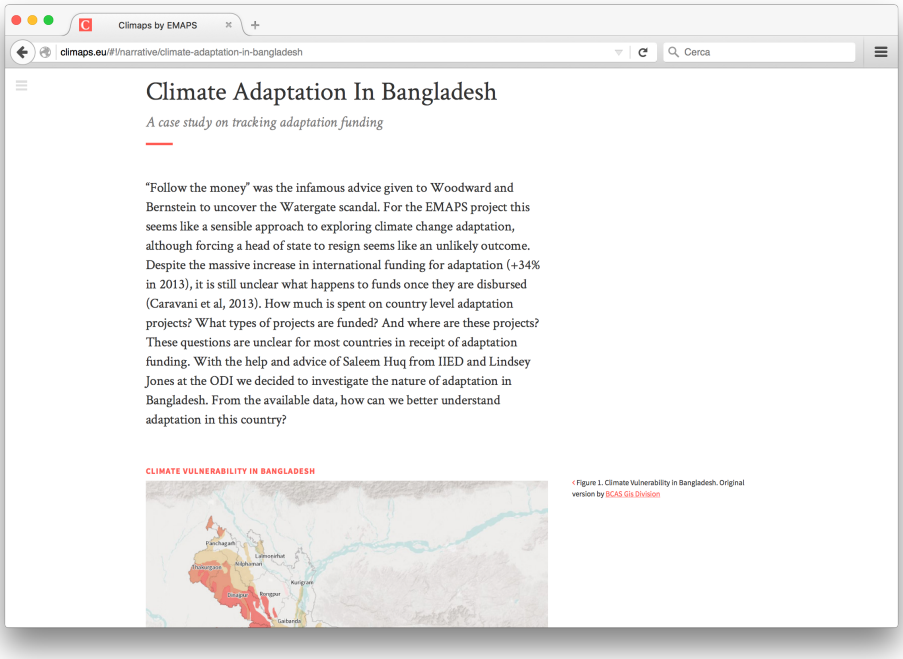


Figure 8. An example of narrative page.

Map pages, instead, provide only the diagram and its context, allowing the user to explore freely. The map's page (example in figure 9) provides the following:

- how to read it: a short description on how it works;
- how the map was built: the protocol applied to collect, refine and analyse the underlying data;
- Findings: what the researchers found using the map, starting from their original research question;
- Tools: the tools eventually used in the analysis;
- Data source: the original source of data;
- Data files: the final dataset used to produce the issue map;
- Source files: the editable files of the presented map (e.g., source code for interactive maps, an editable file in an open format for the static ones).
- Related narratives: narratives on the platform where the map is used to highlight a specific topic; and
- References, authors, acknowledgments.

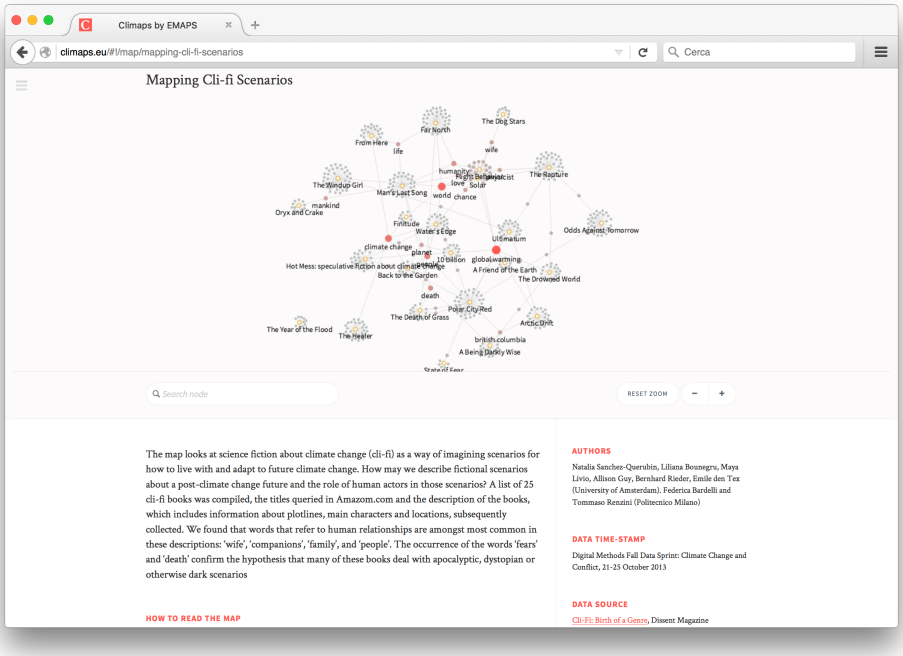


Figure 9. An example of a map page.

With such information, users can freely explore the diagrams. More importantly for the project, users are able to go beyond the map itself: they can download the source data and produce new and unexpected explorations of the topic.

9. Open Issues

Some criticalities that emerged during the project remain open. While the sprint method allows one to outline several exploration paths, there is a risk of losing memory of the design process if the sprints are not properly managed, making the results useless for research purposes. Without a proper organisation and a description, results become “black boxes”: sources are known, outcomes are available, but the performed transformations are lost. This experience demonstrated that one of our priorities should be to avoid this “blackboxing” effect. The created artefacts should be able to express results, but the link with sources should also be kept clear. During the first three sprints, more than 120 visualisations were produced with different levels of complexity, both in terms of analysis and design/interaction. Looking at the high number of artefacts, doubts emerged because visualisation is sometimes used because of its nature as a “finite object”. In other words, the doubt is that visualisations will be used to cover up possible inconsistencies in the analyses by presenting them in a visual compelling way. Finally, during the exploratory sprints we focus too much on the experimentation of new visual models for representing the collected data, sometimes creating artefacts difficult to update or to reproduce. As previously stated, the design component should focus on the development of processes that are simple to iterate.

10. Conclusions

In this paper, the experience of designing “issue maps” is offered as a useful tool for exploring public debate through digital traces. The experience occurred during the EMAPS project, and through its phases, we were able to define a proper workflow for the design of issue maps: a process divided in two phases, exploration and communication, where diagrams have different roles. The experience highlighted the nonlinearity of such exploration, and in the paper, we described an approach that we identified to deal with it, namely the 'sprint' approach.

The outcomes of this research rest on three levels: the first involves design practice, the second includes CM and DMs, and the third is comprised of case studio topics (climate change adaptation). As for design practice, this research is useful for defining an approach to projects based on digital traces, dealing with their instability and volatility. On the second level, we defined a collaborative approach between designers, social scientists and media scholars, defining the role of design in the development of issue mapping. Finally, the research output, available through the publicly-available Climaps platform is valuable for the actors involved in the climate change adaptation debate.

11. References

Anceschi, G. (1988). *Monogrammi e figure (2nd ed.)*. Firenze: La casa Usher.

Dougherty, M., Meyer, E. T., Madsen, C. M., Van den Heuvel, C., Thomas, A., & Wyatt, S. (2010). Researcher engagement with web archives: state of the art. Joint Information Systems Committee Report, August 2010.

Ginsberg, J., Mohebbi, M. H., Patel, R. S., Brammer, L., Smolinski, M. S., & Brilliant, L. (2009). Detecting influenza epidemics using search engine query data. *Nature*, 457(7232), 1012–4. doi:10.1038/nature07634

Heer, J., & Shneiderman, B. (2012). Interactive dynamics for visual analysis. *Communications of the ACM, 55*(4), 45. doi:10.1145/2133806.2133821

Latour, B. (2008). A Cautious Prometheus? A Few Steps Toward a Philosophy of Design (with Special Attention to Peter Sloterdijk). In F. Hackne, J. Glynne, & V. Minto (Eds.), Proceedings of the 2008 Annual International Conference of the Design History Society (pp. 2–10). Falmouth.

Ricci, D. (2010). Seeing what they are saying: Diagrams for socio-technical controversies. In D. Durling, R. Bousbaci, L.-L. Chen, P. Gauthier, T. Poldma, S. Rowoth-Stokes, & E. Stolterman (Eds.), *DRS2010 - Design & Complexity*. Montréal.

Rogers, R. (2009a). Text prepared for the Inaugural Speech, Chair, New Media & Digital Culture, University of Amsterdam 8 May 2009, (May), 1–25.

Rogers, R. (2009b). The Googlization question, and the inculpable engine. Deep search: the politics of search engines beyond google. *Innsbruck: Studien Verlag*, 173-184.

Rogers, R. (2010). Why Map? The Techno-epistemological outlook of Richard Rogers. *Piet Zwart Institute.*

Rogers, R. (2012). Mapping and the politics of web space. *Theory, Culture & Society, 29*(4-5), 193–219. doi:10.1177/0263276412450926

Rogers, R. (2013). *Digital Methods*. Cambridge, MA: MIT Press.

Segel, E., & Heer, J. (2010). Narrative visualization: Telling stories with data. *IEEE Transactions on Visualization and Computer Graphics, 16*, 1139–1148. doi:10.1109/TVCG.2010.179

Venturini, T. (2008). Piccola introduzione alla cartografia delle controversie. *Etnografia e ricerca qualitativa*, 3, 369–394. doi:10.3240/28307

Venturini, T. (2012). Building on faults: How to represent controversies with digital methods. *Public Understanding of Science (Bristol, England), 21*(7), 796–812. doi:10.1177/0963662510387558

Venturini, T., & Latour, B. (2010). The social fabric: digital traces and quali-quantitative methods. In *Proceedings of Future En Seine 2009* (pp. 87–101). Editions Futur en Seine.

Venturini, T., Ricci, D., Mauri, M., Kimbell, L., & Meunier, A. (2015). designing controversies and their publics. *Design Issues, 31*(3), 74–87. doi:10.1162/DESI_a_00340

Venturini, T., Munk, A., & Meunier, A. (2016). Data-sprint: a public approach to digital research. In C. Lury, P. Clough, M. Michael, R. Fensham, S. Lammes, A. Last, & E. Uprichard (Eds.) *Interdisciplinary Research Methods* (forthcoming).

Wellman, B. (2004). The three ages of internet studies: Ten, five and zero years ago. *New Media & Society, 6*(1), 123–129. doi:10.1177/1461444804040633

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