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# Engaged research-led teaching

*composing collective inquiry with digital methods and data*

Gray, Jonathan; Bounegru, Liliana; Rogers, Richard; Venturini, Tommaso; Ricci, Donato; Meunier, Axel; Mauri, Michele; Niederer, Sabine; Sánchez Querubín, Natalia; Tuters, Marc; Kimbell, Lucy; Munk, Anders Kristian

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# Engaged research-led teaching: composing collective inquiry with digital methods and data

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# ENGAGED RESEARCH-LED TEACHING: COMPOSING COLLECTIVE INQUIRY WITH DIGITAL METHODS AND DATA

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**Abstract:** *This article examines the organisation of collaborative digital methods and data projects in the context of engaged research-led teaching in the humanities. Drawing on interviews, field notes, projects and practices from across eight research groups associated with the Public Data Lab (publicdatalab.org), it provides considerations for those interested in undertaking such projects, organised around four areas: composing (1) problems and questions; (2) collectives of inquiry; (3) learning devices and infrastructures; and (4) vernacular, boundary and experimental outputs. Informed by constructivist approaches to learning and pragmatist approaches to collective inquiry, these considerations aim to support teaching and learning through digital projects which surface and reflect on the questions, problems, formats, data, methods, materials and means through which they are produced.*

**Keywords***: engaged research-led teaching, engaged teaching, digital methods, data studies, infrastructure studies, data journalism, science and technology studies, Internet studies.*

## Introduction

There has recently been renewed interest in modes of inquiry that combine "the 'doing', 'researching' and 'making' of social life in potentially new ways" (Marres et al., 2018, p.17). One way in which this interest has manifested is in the proliferation of initiatives exploring how to do collaborative and participatory digital research projects with external actors, working with and addressing concerns of affected communities.[1] What is perhaps less frequently and explicitly discussed is how such projects may be undertaken together with students, including the practical, material and logistical considerations involved in making such collaborations work.

For many of us teaching and research are intertwined. Often our research projects and external collaborations involve students and student-researchers at some point. This paper draws on projects we have undertaken together with students and external collaborators, grounded in areas including digital methods, techno-anthropology, digital sociology, digital science and technology studies (digital STS) and design studies. It builds on previous work by several authors on participatory forms of inquiry in these fields (eg. Marres, 2007, 2017; Birkbak et al., 2018, 2021), as well as on specific collaboration formats such as the data sprint (Venturini et al., 2018; Munk et al., 2019a; Munk et al., 2019b).

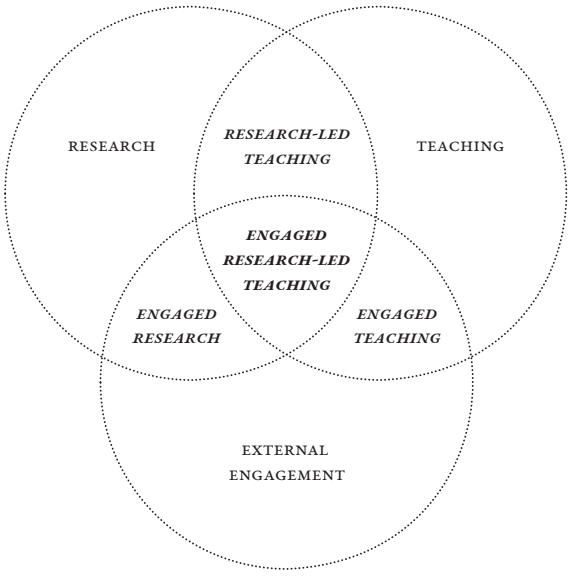



*Figure 1: The "triple stack" of engaged research-led teaching.*

The combination of these activities might be described as "engaged research-led teaching" compiled into the "triple stack" of three core areas of academic work: teaching, research and public engagement (Figure 1).[2]

[1] For example, the Data Justice Lab, the UCLA Center for Critical Internet Inquiry, the Ada Lovelace Institute, the AI Now Institute, the Data & Society Research Institute, the Stanford Digital Civil Society Lab, the Digital Democracies Institute at SFU, the Ida B. Wells Just Data Lab, the Utrecht Data School at Utrecht University, the Critical Media Lab in Basel, and The Data + Feminist Lab at MIT.

[2] This framing was sparked by conversations about "research-led teaching" and external engagement around teaching at King's College London, which led us to ask about how these three kinds of activities can be combined. More about this at: https://www.kcl.ac.uk/research/engaged-research-led-teaching

These practices re-organise the teaching situation, moving beyond conventions that teachers and learners might be accustomed to, and requiring particular adjustments, settings and arrangements to work. Documenting and reflecting on these practices has provided us with an opportunity to learn from each other, and we hope it may be relevant for those others doing similar work. Accounting for these approaches may be relevant for educational research on teaching methods and STS-inspired work on social research methods. It may also have implications for broader debates about the role of universities in society.

To this end, in this article we discuss engaged research-led teaching in the context of digital research projects with a participatory and reflexive sensibility towards the composition, settings, politics and social lives of issues, devices and infrastructures (which for the sake of brevity we will refer to simply as "digital projects" from now on). These reflections draw on experiences with this teaching practice across ten research groups associated with the Public Data Lab and across BA and MA courses ranging from Digital Methods to Data and Digital Journalism, Issue and Controversy Mapping.[3] They also draw on field notes and collections of materials from projects produced with groups of students and collaborators from outside the classroom, and interviews that two of us organised as part of an initiative on engaged research-led teaching supported by King's College London.

In the first section we situate this teaching culture as well as its broader relevance. The following sections discuss how teaching is modified in this approach, more specifically in relation to the recomposition of (1) problems and questions, (2) collectives of inquiry, (3) learning devices and infrastructures and (4) vernacular, boundary and experimental outputs. The projects have been selected to reflect the different backgrounds and emphases we bring to our work. What we share is an overlapping bundle of affinities, sensibilities, experiences and habits, rather than a single programme, approach or way of doing things. What follows are some considerations informed by what we have learned. These may be adapted and translated to the circumstances and constraints of readers who are interested in experimenting with how to combine teaching, research and external engagement.

## Situating engaged research-led teaching with and about the digital

We approach our teaching from our backgrounds in science and technology studies (STS), new media studies, internet studies and associated fields. In such fields, digital data, digital methods and digital infrastructures are thematised and foregrounded rather than taken for granted. Methods are *in* and *of* the world, invested with particular purposes, sponsors and resources, and "actively engaged in doing the social" (Law et al., 2011, p. 6; cf. Law and Ruppert, 2013; Ruppert et al., 2013). We follow "post-instrumentalist" perspectives taking digital devices as fully-fledged actors rather than "mere means" (Marres, 2012, p. 30).

In work on issue mapping, following from science and technology studies, we attend to the socio-technical organisation of issues online, including, for example through the analysis of hyperlinking patterns to study "issue networks" (Marres, 2007, 2015; Marres and Rogers, 2005; Rogers et al., 2015). From new media studies, the involvement of digital "methods of the medium" (Rogers, 2013, 2019) in

[3] The groups associated with the Public Data Lab include (in alphabetical order): the CNRS Center for Internet and Society; DensityDesign Lab at Politecnico di Milano; the Department of Digital Humanities at King's College London; the Digital Methods Initiative and the Open Intelligence Lab at the University of Amsterdam; the médialab at Sciences Po, Paris; Media of Cooperation at the University of Siegen; the Social Design Institute, University of the Arts London; the Techno-Anthropology Lab at Aalborg University Copenhagen; and the Visual Methodologies Collective at Hogeschool van Amsterdam. More about these groups and centres can be found at: https://publicdatalab.org/

producing collective life can be explored by repurposing them in the context of social and cultural research, to address questions other than intended, including through "inventive methods" (Lury and Wakeford, 2012) and "critical analytics" (Rogers, 2018). Digital methods are not just instruments for securing knowledge, but also may be involved in the composition of objects of study in particular ways (Venturini et al., 2018). Similarly, as we discuss further below, methods are involved in the composition of problems, not just means of securing good representations of states of affairs in response to problems which are given in advance (Lury, 2020).

Fields such as science and technology studies, internet studies and social design also have a particular interest in engagement and participation, both as an object of study as well as an aspiration for digital research (Fish et al., 2011; Kelty, 2017; Marres, 2012; Sismondo, 2008; Lezaun et al., 2017; Nold et al, 2022). Several of the authors of this paper were involved in the "Electronic Maps to Assist Public Science" (EMAPS) project, led by Bruno Latour, which sought to explore how controversy mapping (Latour, 2007; Venturini, 2010, 2012) could be undertaken in a participatory manner, including through "collective inquiry" (Latour, 2013) with and for various actors involved in or affected by the controversies being mapped, and leading to a set of maps on climate change, ageing and other issues (Rogers et al., 2015).[4] Controversy mapping has also been developed as a pedagogical approach, encouraging students to attend to multiple actors, positions and associated forms of knowledge in societal controversies (Elam et al., 2019; Solli et al., 2017), as well as how different perspectives are embedded and enacted through media artefacts and expert cultures (Boullier, 2014). At Sciences Po this has resulted in the production of hundreds of atlases involving both students and external collaborators in various ways.[5]

Under the auspices of the EMAPS project, we began to consciously experiment with the "sprint" format (on which more below), working with both students and external collaborators in focused five-day workshops (Berry et al., 2015; Munk et al., 2019a, 2019b; Rogers and Lewthwaite, 2019; Venturini et al., 2015; Venturini et al., 2018). This format is one that several of us had been familiar with from other professional contexts, including free/open source software development, data journalism, civic tech, design practices in business and the public sector and in the notions of "book sprints" and "policy sprints" (Kimbell, 2019).[6]

Approaches to collective inquiry cultivated in these disciplines depart from "engaged" teaching activities where the learning objective concerns acculturation with a particular kind of professionalised practice, or activities are mainly focused around a fixed, pre-given and typified set of needs or problems from an external collaborator. Our outlook is experimental, empirical, open-ended, reflexive and critically minded, attending to the unruliness of problems, the dynamics of media, and the changing interests of those involved. The resulting projects are multivalent, configured to produce both new insights in our research fields, to explore new ways of seeing and doing things that could be salient for collaborators from outside the university and to support enriching student learning experiences.

In the context of data journalism we have described this as "critical data practice" (Bounegru and Gray, 2021; Gray, 2018), combining critical reflection with hands-on practical experimentation in order to explore the possibilities and limits of digital data for reporting, informed by Agre's notion of "critical technical practice" which involves "one foot planted in the craft work of design and the other foot planted in the reflexive work of critique" (Agre, 1997). This includes experimenting with how critical, conceptual and empirical engagements with objects of inquiry might make a difference in practice.

[4] See also "Climaps, a Global Issue Atlas of Climate Change Adaptation": http://climaps.eu/
[5] https://controverses.sciences-po.fr/
[6] https://wiki.digitalmethods.net/Dmi/WinterSchool2013

Our approaches to teaching participatory digital methods research is informed by constructivist, pragmatist, experimental and experiential teaching philosophies, such as the notion of "learning by doing" inspired by Dewey (1897) and his laboratory schools (see also Lewthwaite and Nind, 2016; Mayhew and Edwards, 1936). These principles are embedded in teaching, research and practice in creative design (Buchanan, 2001; Dixon, 2020; DiSalvo, 2022). There are also points of connection with more recent conceptions of "active learning" (Chickering and Gamson, 1987) and "inquiry-based learning" which aims to "reconceptualis[e] students and instructors as compatriots in the search for knowledge" (Justice et al., 2007). Such pragmatist pedagogies aim to relate learning to student's experiences and real-world issues (Dewey, 2008), including through "challenge-based" approaches (Johnson et al., 2009) or "project-based learning" (Blumenfeld et al., 1991) and "collaborative inquiry learning" (Bell et al., 2010). There are also affinities with participatory, critical and action-based research pedagogies which encourage collective processes of learning, inquiry and action in support of social transformation and addressing social inequalities with the involvement of students, researchers and those affected by inequalities (see e.g. Kindon et al., 2010; Pain et al., 2013; Freire, 2000).

## 1. Problems and questions

In this section we discuss how problems are composed and re-composed in collaborative digital projects. A problem, issue or question typically serves as a starting point for "learning by doing" in our classes with digital methods and data, even if this initial prompt almost always changes over the course of inquiry as part of students' learning experience in developing a sensibility towards how problems take shape.

### *Questioning with issue experts*

How to begin? We often start *in medias res*, in the middle of a situation, with a problem, issue or question to be explored (Latour, 2007). For Dewey (1938) inquiry starts with an "indeterminate situation", in the sense that there is something which is unsettled or unresolved, some imbalance, some troubling difference between what is needed and what is there.

The process by means of which the problem is defined may lead to different types of projects. Richard Rogers contrasts projects which are "expert driven" (informed by the needs and concerns of an external collaborator) and projects which are "issue driven", starting with where issues are happening on the web and social media, which may in turn lead to the identification of possible collaborators or co-inquirers.

Projects which are "expert driven" may begin with listening carefully to the problems and situations of external collaborators and their most pressing or urgent analytical needs.[7] For example, most projects at the Digital Methods Initiative (DMI) start by asking an expert the following three questions:

- *What is the state of the art of your field?*
- *What are your current pressing research needs?*
- *What could web data add?*

These questions may also elicit "mapping fantasies" or "dashboard fantasies" and encourage collaborators to think aloud about what they would imagine the ultimate outcome of the project to be.[8] For example, in one project the Open Society Foundations were interested in mapping the

[7] Interview Axel Meunier.
[8] Interview with Richard Rogers.

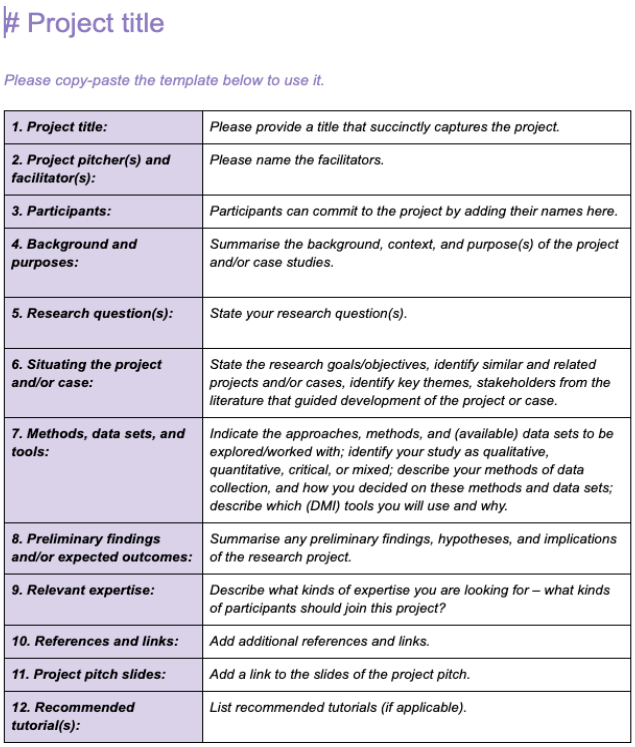
populist right and right-wing extremism online,[9] in another the European Forest Institute were interested in mapping online engagement around the 2019 Amazon forest fires,[10] and in other projects First Draft were interested in mapping misinformation around the US elections and COVID-19 vaccination efforts.[11] In the Infodemic project, we conferred with conspiracy theory researchers about key topics of interest around COVID-19 conspiracies and then workshopped these with journalists and non-profits to co-develop a set of project pitches, also drawing on previous digital methods projects.

Exploratory digital research may also help to identify and situate possible collaborators. For example, one approach to mapping issue networks may take a physical event or gathering as a starting point for mapping associations on the web (Rogers, 2013). Digital maps and visualisations may also be produced preceding contact with external organisations and actors and used as elicitation devices in what one could call a "stakeholder happening",[12] in order to understand more about their analytical concerns. One may use various forms of media "snowballing" – of queries, hashtags, links, groups, recommendations – to find prospective co-inquirers.

*Questioning with students*

Besides questions proposed by (or co-developed with) issue experts, research questions may also be developed by teachers or the students themselves. For example, at the Amsterdam School of Applied Sciences students are asked to formulate research questions and project ideas on climate change following presentations from researchers and external guests. At the DensityDesign Lab teachers provide suggestions for topics, themes and issues around which the students develop project proposals that are subsequently shared back with guests from an NGO they were working with (Mauri et al. 2019).

[9] http://www.govcom.org/populism/GCO_DMI_Populism_final_6May2013.pdf
[10] https://publicdatalab.org/projects/out-of-the-flames/
[11] See https://wiki.digitalmethods.net/Dmi/FakeNewsSprint & https://wiki.digitalmethods.net/Dmi/SummerSchool2020ModeratingCovidMisinfo
[12] A phrase proposed by Richard Rogers while discussing engagement formats.



# Project title

*Please copy-paste the template below to use it.*

| | |
|---|---|
| **1. Project title:** | *Please provide a title that succinctly captures the project.* |
| **2. Project pitcher(s) and facilitator(s):** | *Please name the facilitators.* |
| **3. Participants:** | *Participants can commit to the project by adding their names here.* |
| **4. Background and purposes:** | *Summarise the background, context, and purpose(s) of the project and/or case studies.* |
| **5. Research question(s):** | *State your research question(s).* |
| **6. Situating the project and/or case:** | *State the research goals/objectives, identify similar and related projects and/or cases, identify key themes, stakeholders from the literature that guided development of the project or case.* |
| **7. Methods, data sets, and tools:** | *Indicate the approaches, methods, and (available) data sets to be explored/worked with; identify your study as qualitative, quantitative, critical, or mixed; describe your methods of data collection, and how you decided on these methods and data sets; describe which (DMI) tools you will use and why.* |
| **8. Preliminary findings and/or expected outcomes:** | *Summarise any preliminary findings, hypotheses, and implications of the research project.* |
| **9. Relevant expertise:** | *Describe what kinds of expertise you are looking for – what kinds of participants should join this project?* |
| **10. References and links:** | *Add additional references and links.* |
| **11. Project pitch slides:** | *Add a link to the slides of the project pitch.* |
| **12. Recommended tutorial(s):** | *List recommended tutorials (if applicable).* |

*Figure 2: Project pitch template document from Digital Methods Initiative.*

Particularly in "expert driven" projects, the initial exploration of problems is followed by the development of a project pitch (see Figures 2 and 3). The project pitch specifies relations between issues, actors, questions, methods, datasets and other materials. By means of the project pitch, initial interests are co-developed into research questions and protocols for collective inquiry. At this stage the exploration and collection of relevant data also begins. The pitch document contains links with further context, background information, relevant studies, as well as, crucially, tutorials, worksheets and materials that may be relevant for students who opt to work on the project.

Brief walkthrough of project pitches

1. Hashtag Creativity
2. Cross-Platform Phobias
3. Images, Aesthetics & Memes
4. Conspiracy "Singularity" & Conspirituality
5. Monetisation & Social Merchandise
6. Deplatforming & Stigmatized Knowledge
7. Epistemic Keywords

*Figure 3: Project pitches from the Infodemic project.*[13]

[13] https://infodemic.eu/

*Questioning with digital methods and data*

The process of making project pitches often involves the transformation of initial starting questions and curiosities, as well as the involvement of online devices, data, and methods in shaping the orientation of inquiry. Thus, it may be helpful to think of questions as being formulated and reformulated in action, rather than fixed and given in advance. To work with digital data from the web and online platforms is often to repurpose materials which are "not our own", i.e., not made for scientific research (Marres and Gerlitz, 2015). The initial process of composing problems and research questions with digital methods and data is thus often speculative and exploratory, seeing what is available, seeing what may be made to fit, and working with the shape of found materials. In this sense preparing project pitches may be characterised as a process of foraging and bricolage.

Thus, digital methods, datasets and infrastructures can be substantively involved – alongside teachers, subject matter experts, students and others – in the co-development of questions and the (re-)formulation and (re-)composition of issues and problems. Setting these projects into motion involves the assembly and curation of a collective of inquiry, the composition of which may be adjusted in the process. Collaborative digital projects may thematise and question the composition of problems, as Celia Lury (2020) has written about recently in her book on "problem spaces" and "compositional methodology". This orientation of attending carefully to (and possibly rethinking) the formulation of problems and questions has also been informed by research on the socio-technical organisation of publics and issues (see, eg. Marres, 2005, 2007, 2015). In the context of the médialab at Sciences Po, this material sensibility towards the composition of problems is also informed by art practice and Bruno Latour's "compositionist manifesto" (Latour, 2010) and "Experimental Programme in Political Arts" (SPEAP) (Ricci, forthcoming).[14]

*Questioning differently*

Different co-inquirers may have different questions. For example, in one project on "climate cleanup" an external organisation was interested in "building a field of climate entrepreneurs".[15] Students and researchers noticed that different actors used different terms. While the external organisation was interested in mapping actors to build alliances and "streamlining a shared narrative", researchers were interested in the differences in language, framing, issues and concerns and what could be learned from this about the climate politics in this space.

Sometimes projects start with one question and shift to another over the course of inquiry. Several of our collaborations around the Public Data Lab have explored how digital data, methods and infrastructure are involved in the composition of public problems, articulating them and making them addressable in particular ways, as well as how they may be reassembled and respecified. For example, the *Field Guide to "Fake News"* documents methods for exploring misinformation not just as a problem of truth or falsity of claims, but also in relation to the dynamics of platforms and infrastructures through which such claims are circulated, valorised and monetised. A project with the European Forest Institute explored how hashtags and images were involved in contested "issuefication" of 2019 Amazon forest fires, and how digital media could be used not just to fact-check problematic claims, but also to understand different ways in which the forest fires came to matter for different actors.[16] Save Our Air explored how digital data could serve not just to produce representations of particulate matter, but also to unfold different conceptions of who is responsible for producing and addressing it.[17]

[14] http://blogs.sciences-po.fr/speap/
[15] https://climatecleanup.org/
[16] https://publicdatalab.org/projects/out-of-the-flames/
[17] https://saveourair.publicdatalab.org/

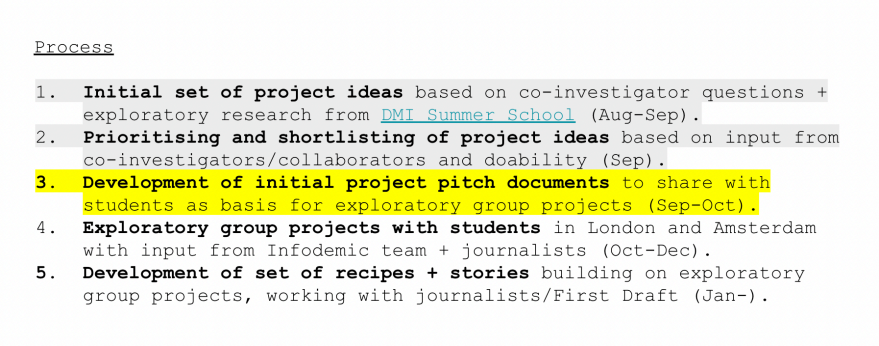



*Figure 4: Slide presenting the collaboration process created in the Infodemic project.*

As discussed below, group project notes and research diaries may document how questions and concerns change over the course of a project, from project pitches to exploratory group work, to the refinement of final outputs (Figure 4). This can encourage attention to how questions become more or less salient against a background, whether of research literature, previous learning experiences, the professional contexts of external collaborators, or thinking along with (or in contrast to) the defaults and affordances of online devices. Assembling collectives of inquiry may involve rearranging questions, methods, tools, datasets and materials to focus on needs which may be different to the analytical defaults of digital devices and online media, such as looking at voice, commitment or positioning, rather than a focus on vanity metrics or the "most engaged" (Rogers, 2018).

Making collective inquiry work can involve finding alignment between different forms of questioning, of finding questions which may emerge as of common interest to those involved or developing different questions to address the interests of different contributors. In the process and documentation of these projects inquirers can reflect on: Where do projects come from? Why some questions rather than others? Against which background does a question come to matter? What is required to make things answerable? Thus collective projects can help to cultivate appreciation for the situated character of questioning – and how different kinds of questions imply and involve different kinds of methodological setups to make them answerable, which may be more or less doable or available.

For learners in such projects engagement with questioning starts not with classroom debates, but hands-on encounters with practical arrangements of answerability with digital devices, methods and materials. For example, in one teaching exercise at the University of Amsterdam, students were asked to account for different kinds of digital analytics tools, in order to surface and situate their methodological specificity. The learning process may also involve exploring different styles of data work. Many of the project involve questioning grounded in "quanti-qualitative" digital research, working more closely with smaller datasets and a more interpretive sensibility (Rogers, 2019; Venturini and Latour, 2010).

As discussed above, with many of the collaborative digital projects we have worked on, questions are not "readymade", interests are not fixed in advance and roles are not necessarily clear cut. For example, students may also have backgrounds as practitioners or may also be teachers; practitioners may also be researchers or students. Different actors also have different time constraints, and not everyone will be able to be involved in all parts of the process (as discussed below). These kinds of collaborative digital projects are experimental and open-ended. They have a critical sensibility and aim to be transformational in the sense that those who take part in them

come away with perspectives and understandings which may be different from what was expected. Natalia Sánchez-Querubín suggests having early conversations about the experimental character of these projects with prospective collaborators. She notes that rather than asking them to provide a ready-made list of questions, these conversations may be used to expand the list and change the kinds of questions being asked.

## 2. Collectives of inquiry

Who is involved and how will we work together? Collaborative digital projects involve the negotiation of overlapping, rotating and shifting *roles*, as well a *setup* which will assemble and hold a collective of inquiry together at least for the duration of the project.

*Playing roles*

In engaged research-led teaching situations participants need to become comfortable with inhabiting hybrid roles. This includes the layering of roles associated with participatory research and teaching: teacher-researchers, student-researchers and external collaborators, who may play one or more roles, including issue expert, learner and researcher.

Achieving a shared understanding is important to ensure that no one of these roles overshadows the process at the expense of others. Students and researchers are not only there to provide assistance to external collaborators, who in turn are not only there to provide material for the projects of students and publications of researchers.

Common ground and alignment must be found between these different considerations, by drawing on their respective settings, associated formats and modes of valuation. Students self-observing digital projects have noted moments where they felt as though external collaborators were treating them as interns.[18] External collaborators may feel short-changed if they invest time and energy and feel that the project goes down a research rabbit hole which does not speak to their concerns.

Collaborative projects involve finding ways to work together across different practices and vocabularies, which the DMI calls "transcultural discourses": "The transcultural discourses are about learning how to talk to people productively. For programmers how to talk to designers, how to talk to analysts if you're a programmer".[19] It can also involve different ways of re-organising relationships. For example, teachers and students working together as co-inquirers; teachers becoming facilitators; or journalists seeing researchers as collaborators in their investigations rather than sources providing quotations for their reports.

*Experimental settings*

Our collaborative projects are often experimental, exploratory and have a critical sensibility. The goal is for the process to support learning for all and shifts in perspective about the role of digital methods and data in the composition of problems and addressing of questions. They are not necessarily oriented towards coming up with a solution to a fixed problem or question defined at the outset, but rather to encourage the learning of all their participants which may involve the respecification of problems, the discovery of a method, or a different understanding of a situation.

Digital projects may provide external collaborators with a "safe space" for critical engagements, leveraging the comparative independence of the university setting for exploring different

[18] As noted in a student ethnography from a project with the TANTlab.
[19] Interview, Richard Rogers.

perspectives on what they do. While critical inquiry grounded in social research is a staple of research and teaching, it is worth remembering that not everyone is in a situation where particular forms of academic critique are valued or welcome.[20] It may be worth having conversations about privacy and public attribution at the outset to ensure that partners are not put into a difficult position by being named in relation to material which is more widely shared.

*Making time*

Initial discussions may include the expected time scales and time commitments for partners, as well as how they might benefit from the process. There are many ways of organising encounters with external collaborators, from ongoing involvement in workshops, sprints and group work, to occasional input and feedback for project briefs, review moments and final presentations. In some cases external collaborators can also be contacted after a phase of exploratory research, for example, by first designing a series of maps of an issue or topic and then sharing them with the actors who feature in them (Rogers, 2004).

Teaching is often scheduled around discrete, standardised units of time – such as two-hour lectures and two-hour seminars. External experts come with their own deadlines and attention cycles. And research follows its own rhythms of projects and publication. Doing engaged research-led teaching involves finding workable arrangements between these different temporalities.

It makes sense to plan projects backwards from the time available and to ensure that goals and anticipated outputs are commensurate with this. Besides time constraints on the side of external collaborators, there are also questions around blocks of time that can be scheduled as part of taught courses. The DMI Winter and Summer Schools are based around five-day "sprints" which occur every January and July and which follow a specific pattern around which collaborative projects can be planned.

While data sprints from the DMI and other research centres across the Public Data Lab are typically five days, we have also been exploring other event formats to "timebox" and support focused time for work on digital projects, such as regular half-day or day-long workshops. At King's projects are spread across full-day workshops. These scheduled synchronous moments form the backbone of collective work, around which preparatory work, follow-up work, writeups and feedback moments can be planned. During the pandemic, full day offline workshops have been switched to half-day online workshops combined with asynchronous group work, to enable work across time zones and according to the availability of participants. These have been followed by a separate project presentation moment with external collaborators, distinct from the workshops, to give further time for polishing and reflecting on presentations, and to gather feedback and input from external collaborators ahead of the writing of the final reports. For example, here is the sequence of steps that were envisaged for collaborations around the Infodemic project:

1. Collect preliminary ideas and questions for possible projects
2. Create a shortlist of projects
3. Invite researchers to join projects they might like to contribute to
4. Share shortlist with journalists and external collaborators to see if there are projects they might like to follow or join

[20] Interview with Natalia Sánchez Querubín.

5. Project facilitators finalise project briefs ahead of sharing with students
6. Team formation with researchers, students and external collaborators
7. Create and share project infrastructure for all groups (including group project folders, chat space, etc)
8. Project facilitators and teams develop their projects together at workshops (with check-in moments with external collaborators)
9. Final project presentations with external collaborators

*Learning before classes*

Often digital projects will use a "flipped classroom" approach (see eg. O'Flaherty and Phillips, 2015) where a package of learning materials will be provided in advance, including readings, tutorial videos and worksheets (Figure 5). One area of ongoing collaboration at the Public Data Lab is developing, gathering and sharing worksheets and tutorials that may be of interest across the network.[21] The focus of worksheets and recipes is not on the acquisition of practical skills per se, but rather to provide a starting point and to cultivate a sensibility for configuring methods, materials and techniques to students' own questions and projects.

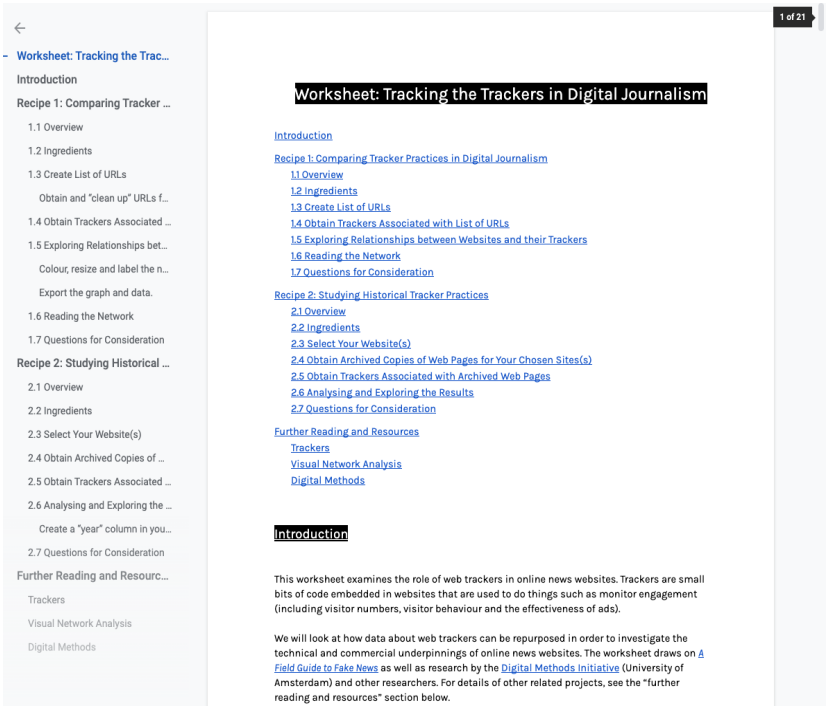



*Figure 5: Worksheet on web trackers.*

Some students may have also done previous courses or seminars and have some familiarity with digital methods and tools being used. Course materials may also introduce this "learning by doing" approach with external collaborators (Figure 6) and may provide a roadmap for key moments in collaborative projects that students can plan around.

[21] See, eg. https://publicdatalab.org/projects/digital-methods-recipes/

*Gathering attention*

Taking an empirical perspective on what gathers and holds publics together (Latour and Weibel, 2005; Marres, 2005, 2007, 2012), we cannot take for granted the time or attention of either external participants, including "already busy publics" (Birkbak et al., 2018), busy professionals ("people working for NGOs, they don't have much calm time you know"[22]), or, for that matter, our own students. Engaged research-led teaching should allow all participants to find angles, perspectives and aspects which they are more interested in, for example, by giving them a selection of projects to choose from and then supporting them in exploratory research activities to find their own lines of inquiry.

Sprints and workshops can be envisaged as setups to gather and sustain attention on a project. Sprints are often used as a kind of industrial technique for the containerisation of time and attention – to carve out chunks of time away from overflowing inboxes and other demands and distractions in a way which is recognised, affirmed and protected – in order to *solve problems* and *make things* (Knapp, 2016). In the context of digital research projects the sprint format may be repurposed to provide a similar kind of immersion, but to *transform how problems are understood* and perhaps to *reassemble things* with digital methods and data.

*Adjusting settings for group flow*

In the context of DMI sprints, there is an "attention to minute details", including the "detail of the settings of the software or of the rooms" and tips for staying focused such as "take breaks seriously" (Figure 7, Figure 8).[23] Typically DMI sprints start with presentations from external collaborators and project pitches on day one; proceed to the formation of subgroups on day two; with the aim of wrapping things up by the end of day four; ahead of finalising and presenting on day five. They are intended to provide an environment for focused group work and "group flow".[24] Group work flow is organised by means of scheduling. At the DMI sprint days are organised into hour and a half sessions interwoven with breaks.

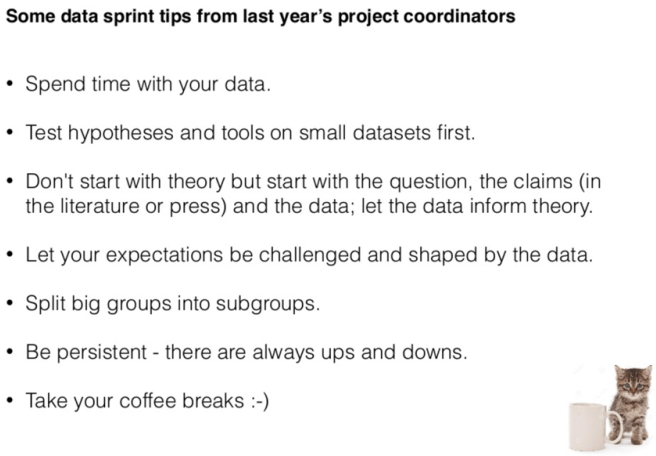
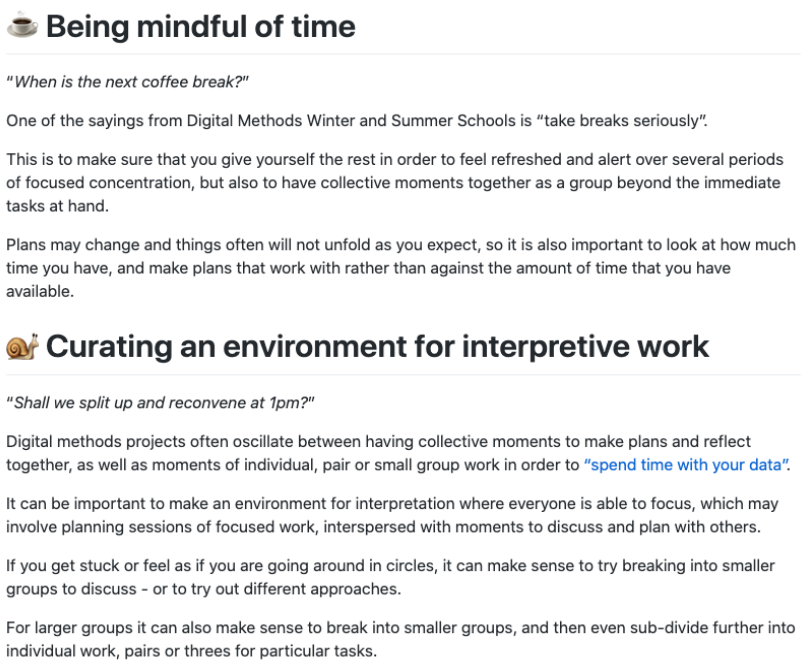



*Figure 7: Excerpt from "What Does a Good Digital Methods Project Look Like?", tips presented at Digital Methods Winter School 2016, University of Amsterdam, 11th January 2016.*[25]

[22] Interview with Richard Rogers.
[23] Interview, Richard Rogers.
[24] Interview, Richard Rogers.
[25] See https://www.slideshare.net/lilianabounegru/what-does-a-good-digital-methods-project-look-like and https://www.slideshare.net/lilianabounegru/doing-digital-methods-some-recent-highlights-from-winter-and-summer-schools-70834115



## ☕ Being mindful of time

*"When is the next coffee break?"*

One of the sayings from Digital Methods Winter and Summer Schools is "take breaks seriously".

This is to make sure that you give yourself the rest in order to feel refreshed and alert over several periods of focused concentration, but also to have collective moments together as a group beyond the immediate tasks at hand.

Plans may change and things often will not unfold as you expect, so it is also important to look at how much time you have, and make plans that work with rather than against the amount of time that you have available.

## 🐌 Curating an environment for interpretive work

*"Shall we split up and reconvene at 1pm?"*

Digital methods projects often oscillate between having collective moments to make plans and reflect together, as well as moments of individual, pair or small group work in order to "spend time with your data".

It can be important to make an environment for interpretation where everyone is able to focus, which may involve planning sessions of focused work, interspersed with moments to discuss and plan with others.

If you get stuck or feel as if you are going around in circles, it can make sense to try breaking into smaller groups to discuss - or to try out different approaches.

For larger groups it can also make sense to break into smaller groups, and then even sub-divide further into individual work, pairs or threes for particular tasks.

*Figure 8: Considerations for organising collaborative digital methods projects.*[26]

Sprints have often been looked forward to as moments to "be there together" and to learn new things, characterised by shared rhythms and interwoven with casual sociality ("let's get coffee").[27] They often involve designerly techniques such as sketching on whiteboards and blackboards, brainstorming post-it notes, physical communication and gestures, spontaneous grouping and regrouping, and moments of group interpretation and deliberation (Figure 9). They culminate in a rush of energy to finish up project slides followed by celebration after the final presentations.

*Figure 9: Post-it wall at Save Our Air project sprint, King's College London, January 2018.*

[26] http://recipes.publicdatalab.org/
[27] Interview, Natalia Sánchez Querubín.

In the wake of the COVID-19 pandemic, we have all been adapting to finding ways of bringing the atmosphere of such sprints, workshops and group projects online to our post-pandemic era "screen work" (Boyer, 2013). Some things are harder to replicate, such as the excitement and sociality of the sprint, the affective dimensions, the feeling of being together and maintaining energy levels and shared rhythms.[28] Online sprints also have new possibilities such as being able to jump more easily from group to group, inter-group communication and coordination, having backlogs of chat discussions, collective notetaking, screen-recordings and experiments with collaborative annotation (Figure 10). Sprints can also be adapted to be hybrid, combining both synchronous and asynchronous elements online and offline (Kimbell et al, 2021).

*Figure 10: Collaborative image annotation and grouping at COVID-19 testing sprint, Digital Methods Initiative Summer School, July 2020.*

*Learning across and beyond classes*

As Sabine Niederer puts it, "collaborations also last in different ways post-sprint". While sprints, workshops and projects organise time and work into shared moments, it can also be challenging to follow along with what may unfold from collaborative projects in the longer term. This may also partly be a consequence of how classes, funded projects and programmes are organised, their temporalities and rhythms, and broader "economies of work" which may encourage "going from one thing to the next".[29]

One way of responding to this can be to establish multi-year, cross-institutional collaborations leading to deeper engagements and sustained attention, rather than more fleeting or one-off engagements. Outputs from one round of group projects may provide input for project briefs and

[28] Interview, Natalia Sánchez Querubín.
[29] Interview, Axel Meunier.

other project pitches – often tailored to the needs and setups of particular classes. For example, as part of a broader collaboration with First Draft, projects from the DMI Summer School in July 2020 served as a starting point for projects at King's College London in October-December 2020, which in turn served as the basis for projects at the DMI Winter School in January 2021. Thorough documentation and packages of materials were crucial for this handover process to work. It can also be that some students prefer working individually rather than in groups, and projects may be further developed through individual dissertation projects. While five-day sprints may be a way to sustain time and attention on a project, these moments may form part of a collective of inquiry which is held together across years and classes through materials, people and organisations.

What happens beyond the classroom, and student and researcher writeups is harder to plan. This includes how collaborators incorporate outputs or learnings from the project. Sometimes this can involve follow-up calls or email exchanges to clarify aspects of the project ahead of publication. Sometimes there is further refinement, elaboration or editorial work to create outputs co-developed with external collaborators. Sometimes collaborators prefer to work with datasets and materials independently. This process of learning and incorporation into an external organisation is a moment when teachers become students and external collaborators become teachers.[30] Sabine Niederer, for example, organises "talk back to the map" workshops whereby external collaborators annotate, critique and provide feedback on outputs – often with several iterations of commenting and revisions, whether through emails, calls or events.

## 3. Learning devices and infrastructures

How can we document our collective learning journey? A crucial part of collaborative digital projects is *collective documentation* of what has been done and what has been learned, so that this may be subsequently reviewed, incorporated, built upon and used as the basis for outputs in different formats (eg. reports, articles, investigations). We often use a combination of proprietary software such as Google Drive or Microsoft One Drive (widely used by our universities and external collaborators), open-source software such as Foswiki and Etherpad, as well as bespoke websites and tools for this purpose.[31] The use of proprietary software produced by actors we often critically scrutinise in our projects is itself an issue we frequently debate. In addition to this, the reliance on certain kinds of software tools for our collaborative work and documentation may raise challenges for less well-resourced and software-savvy institutions. Therefore decisions about software and media should be grounded in the existing technical practices of participants in the inquiry.

### *Group foldering*

A starting point for this is a group folder or workspace where materials and notes can be gathered. At the DMI there is a conventional format for organising materials with different subfolders for datasets, graphics and slides (Figure 11).

[30] Interview, Natalia Sánchez Querubín.
[31] Such as the médialab Science Po's Fonio https://medialab.sciencespo.fr/en/tools/fonio/ and Density Design's placplac: https://github.com/densitydesign/placplac

| File/Folder Structure | Purpose |
|---|---|
| /Project Title/ | Main root |
| /Data/ | Folder contains initial data sets and working data sheets. |
| /Graphics/ | Folder contains data visualisations. |
| /Slides/ | Folder contains project pitch slides as well as final presentation slides. |
| Contact Details.gsheet<br>Documentation.gdoc<br>Research Report.gdoc | Files containing a sheet with contact details for all team members, a file for documentation throughout the week, and a file for the written research project report. |

*Figure 11: Guidance on organising group project folder at Digital Methods Winter and Summer Schools, Fernando Van der Vlist.*

A group project diary may also serve as a way to gather notes from meetings, discussions and working sessions. Separate documents may be created for subgroup work, interpretive moments, or different lines of inquiry for the project.

*Documenting datasets*

Given the importance that datasets often play as "boundary objects" between different contexts of inquiry, special care should be taken in documenting their assembly and transformation. For example, at King's we have encouraged projects to keep a "data operations diary" to document how datasets are assembled and subsequently transformed (Figure 12).[32] A copy can be made of full datasets gathered from APIs so that this can be returned to later. If significant changes are made (eg. taking a selection of items and layering on other data), separate numbered sheets can be used as a way to keep different "states" of the data accessible. Similarly, slides may be used to gather and organise material into a broader story about the project drawing on multiple subgroups, and a copy may be taken before making a much shorter "radical edit" for presentation. These two versions may serve different purposes, with one version providing more of an in-depth account of different elements of the project and the other providing a much more succinct account of what has been learned for final presentations.

[32] This approach was developed in collaboration with Gabriele Colombo, prompted by his teaching practice of "staying in the spreadsheet" for as long as possible during data transformation and exploration. See http://recipes.publicdatalab.org/

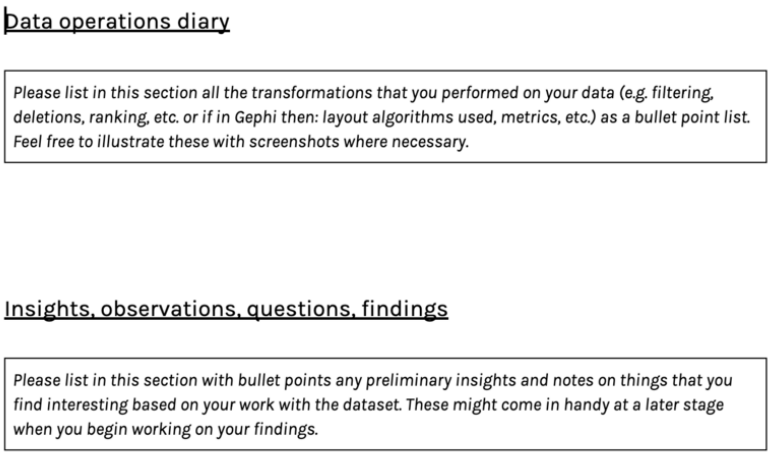



*Figure 12: Example template for data operations diary, King's College London.*

*Taking notes*

Group diaries can also facilitate peer-learning (Topping, 2005), serving as a way to surface and address issues. They also may help to attend to frictions, tensions and "moments of stuckness" where things do not work out as anticipated – a textual equivalent of the "muddiest point" technique (Angelo and Cross, 1993). Slowing down and "staying with the trouble" (Haraway, 2016) may also provide opportunities for shifts in perspectives, new approaches or different ways of formulating inquiry. The notion of "getting to know your data" and granular attentiveness to the specificity of digital material is a crucial part of the learning processes which aims to cultivate an "arts of noticing" (Tsing, 2015) for digital devices, practices, infrastructures and landscapes. Group notes can also help to facilitate small group and pair work, such as interpretive work with datasets, or exercises in making sense of exploratory visual outputs.

Taking and reviewing notes can also help to foreground what is unanticipated, surprising or which may otherwise be filtered out or overlooked. Group notes can also shift understanding about what is learned, for example from a focus on *findings within data* to learning as a kind of *contextual thickening* or *situational sensibility* which may open up different perspectives on the organisation of relationships, the settings of inquiry, or the composition of the problem or issue.[33] In the context of teaching, group project notes can help with reflections on the "learning journey" and group project dynamics. This may be useful when it comes to group assessment, for example allowing additional "peer evaluation moments" or highlighting different forms of contribution to group projects (eg. beyond those which focus on more visible contributions such as analytical or conceptual framing, visualisations or data work).

## 4. Vernacular, boundary and experimental outputs

How can we share what was learned? How does a group orient itself towards the production of materials? What kinds of outputs are desirable? What kinds of formats might the outputs take? In this section we review various considerations for the formats of outputs, including working with vernacular formats, boundary outputs and experimental outputs.

[33] The formulation of this point is inspired by conversations with Noortje Marres.

*Vernacular formats*

In the context of academic work, Robin de Mourat, Donato Ricci and Bruno Latour, speak of academic publication formats as contingent and dynamic "genres associated with a set of cultural techniques and sociotechnological assemblages" (2021, p. 104).

Which outputs make most sense for digital projects depends on the vernaculars – the established conventions of saying and doing things – of the different participants. Collaborative digital projects often start with a consideration of the *vernacular formats* of those involved which may play an anticipatory role in making the project work for those involved. Traditions from creative design often emphasise producing early-stage mock-ups or "prototypes" to link emerging insights with everyday practices (Peukert and Vilsmaier, 2021).

In the Issue Mapping class at the University of Amsterdam, external collaborators are asked "what their ideal issue map might look like, just to have an evocative object for the students to think with".[34] As part of the Infodemic project, we would ask each journalistic collaborator about what they would ideally like to receive, which led to thinking about their content management systems, editorial and publication workflows, graphical conventions, and so on.

At King's College London, we encourage students to carefully study previous outputs of collaborators in order to understand the external partner's preferred formats and ways of telling and how they may be reconfigured by means of digital methods and critical data practice. Similarly, at the Design School at Politecnico di Milano students explore possible visual languages suitable for both the particularities of the digital materials they are working with and the practices and conventions of those for whom their creations are intended (Mauri et al. 2019).

But it is not only external collaborators who have vernacular formats to take into consideration. Researchers also have their own conventions and formats, from research blog posts to book chapters to peer-reviewed articles (Eve and Gray, 2020). Students also have specific vernacular formats which they will be expected to adopt, such as essays or project reports with specific word counts and marking frameworks.

Attending to the material specificity of vernacular formats may guide the activities of collective digital projects in several important ways. The formats can help to ensure that outputs are relevant for the actors involved. They may help to ensure that researchers and students reflect on the practices and circumstances of external actors – from what is publishable (e.g., due to editorial styles or content management systems) to what is meaningful (e.g., by understanding what kinds of observations or stories would be most salient). The constraints of formats may foster creativity and provide a shared container for holding together collective work.

Vernacular formats may also provide the starting point for experimental, creative and critical engagements which transpose, translate or adapt them to produce different ways of making sense by means of digital material. In digital and data journalism classes at King's College London, this includes encouraging students to imagine ways of journalistic storytelling with and about digital devices and infrastructures with a sensibility that is observational or interpretive rather than mainly statistical or computational (Bounegru and Gray, 2021).

*Boundary outputs and multiplying outputs*

There are several strategies for responding to the fact that those involved may have different needs and interests. One may look for *shared formats* which may be useful for students, researchers and

[34] Interview, Richard Rogers.

external collaborators. For example, lists, tables, spreadsheets, datasets, visualisations or slide decks may act as "*boundary outputs*", working across different contexts (Bowker et al., 2015; Star, 2010; Star and Griesemer, 1989) and amenable to being incorporated into further outputs.

As Natalia Sánchez-Querubín suggests, another strategy is to plan for multiple outputs, including student papers to be graded, possible research publications, and formats that work for external partners. Recognising and caring for these "parallel objectives and parallel outputs" helps to ensure that everyone involved benefits and to avoid "things [going] sour when one of these objectives or outputs is missing", such as when learning objectives are not clear, partners do not see what they will gain, or researchers do not see scope for a research output.[35]

These different requirements and contexts can also be thematised in the learning process, such as in group project moments considering how a project question can speak to three different layers, each with different constituents and concerns. Steering the situation so that the same project can work across these different layers is the role of the teacher or project facilitator, whether through the production of one thing that works for all, different cuts of the same material, or planning around multiple different outputs.

*Curated datasets*

Sometimes external collaborators may be interested less in textual summaries or visualisations, and more interested in datasets assembled as part of the project. While certain datasets may come with restrictions on their circulation (e.g. most platform policies do not permit datasets to be shared), often what is most useful are not just raw API outputs, but rather well-curated, well-documented datasets generated through the research process, which require additional work to curate and transform, including making well-reasoned selections and subsets (e.g., query design, time periods), creating summaries, interweaving and combining data from different sources, supplementing with contextual information, interpretive work, classification, adding additional layers, and so on. This additional curatorial and transformational work is required to make different questions answerable. For example, a project on the 2019 Amazon forest fires with the European Forest Institute involved tracing variations of images through qualitative analysis, and creating "cross platform image datasets" (Niederer and Colombo, 2019; Pearce et al., 2018) through designing queries for Twitter, Instagram, Facebook, YouTube and Google Search.[36] Bespoke software tools have been created in order to assemble datasets with "methodological diversity and epistemological plurality" in mind (Borra and Rieder, 2014).[37] This has also meant that datasets from the same project could be used for a variety of different outputs including student presentations and reports, PhD theses, book chapters, research articles and journalistic investigations.

[35] Interview, Natalia Sánchez-Querubín.
[36] https://publicdatalab.org/projects/out-of-the-flames/
[37] See, for example, http://tools.digitalmethods.net/ and https://medialab.sciencespo.fr/en/tools/

*Collaborative texts*

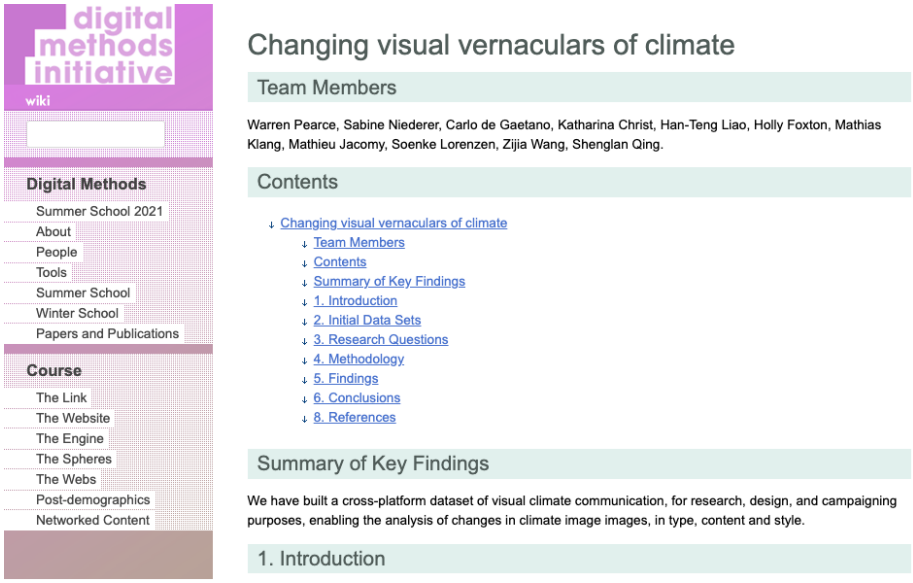



*Figure 13: Example DMI project wiki page from collaboration with Greenpeace.*

Projects are not necessarily or exclusively oriented towards the production of long-form texts in specific formats such as student essays, but often accounting for what has been done and what has been learned will involve creating collective texts along the way, such as descriptions of datasets and methods, summaries of key findings or bullet points of reflections. Texts may be multimodal, incorporating visuals and media such as data visualisations, composite images, video files or GIFs. Alongside Google Drive folders, the DMI uses a wiki for project documentation as it is well aligned with collaboration on experimental work and (Figure 13) enables "far flung collaboration", "multiple authorship", and "concentrated collaborative write ups".[38]

At Sciences Po students develop small project websites and web pages documenting their work (Figure 14), including through dedicated software tools created by the médialab.[39] Information design students at DensityDesign Lab must create web pages for their final synthesis projects which are publicly showcased at the end of each year (Figure 15). These web outputs enable projects to be cited and linked to, providing attribution and acknowledgement, serving as portfolio projects for students, and giving readers of other kinds of outputs (eg. journal articles or journalistic reports) a way to find out more about what was done, how and by whom.

[38] Interview, Richard Rogers
[39] See, e.g., https://medialab.sciencespo.fr/en/tools/fonio/ and https://medialab.sciencespo.fr/en/tools/drive-in/

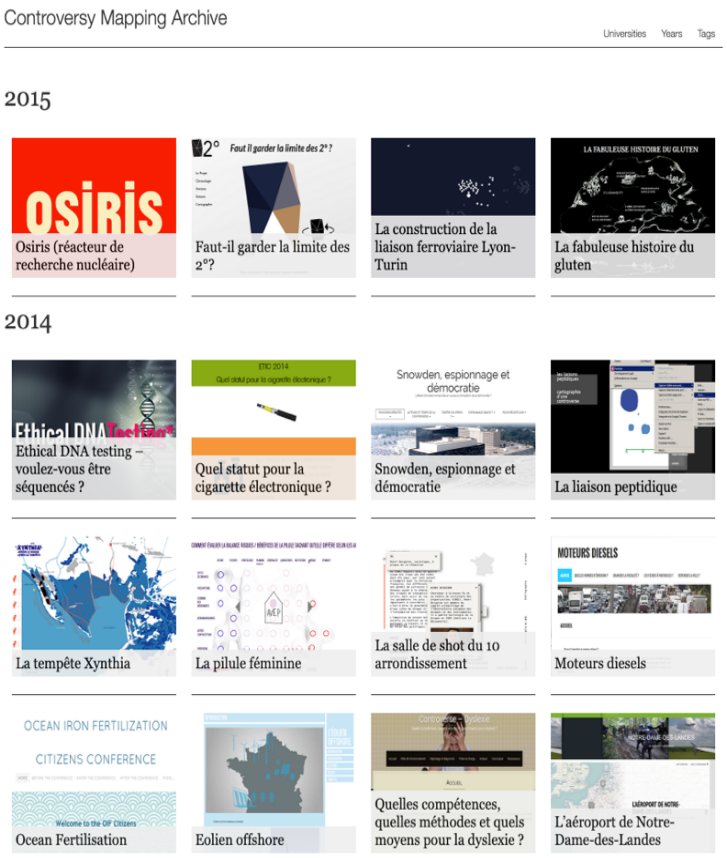



*Figure 14: Archive of controversy mapping projects from Sciences Po.*

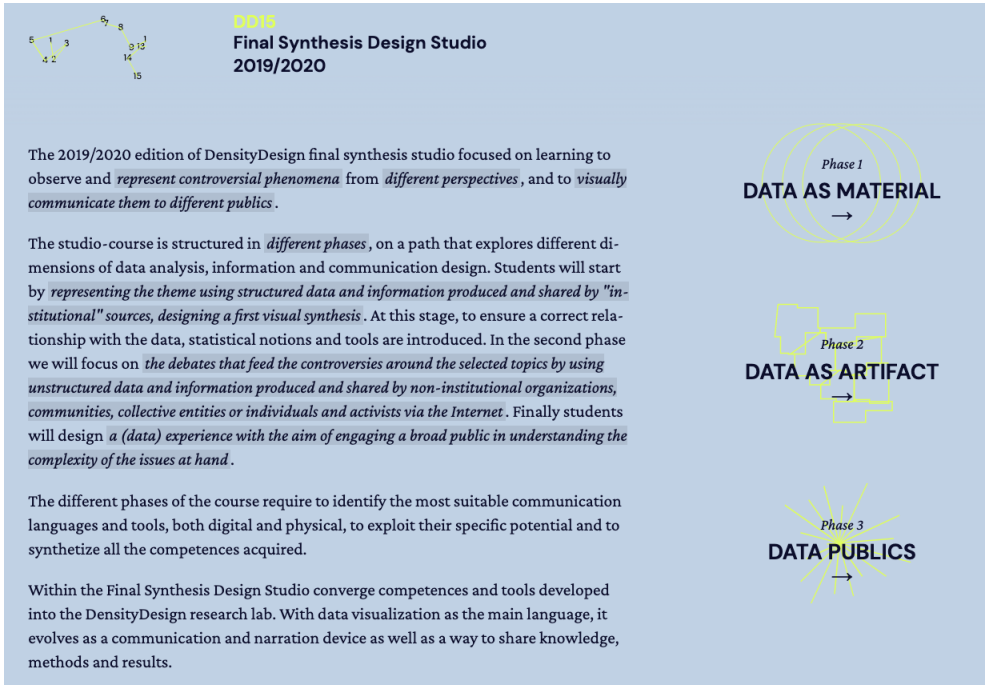



*Figure 15: Website directory for student projects at DensityDesign Lab.*

*Slides, presentations and posters*

Another format for outputs is the slide deck, a commonplace amongst students, researchers and external collaborators alike. Slide decks are often used to collate and present results, such as the final project presentations. They can also be used as a kind of "standalone" output to narrate and share project materials for those beyond the immediate project team (eg. sharing results back with busy but curious collaborators). Slides may also serve as a way for an external collaborator to incorporate learnings into their own narratives and presentations. For many collaborative DMI projects the goal is to produce visual materials that can be incorporated into the slide decks of external collaborators.[40] For example, for a DMI collaboration with FairPhone the output was a "critical layer" for the company's slide deck (Figure 16).

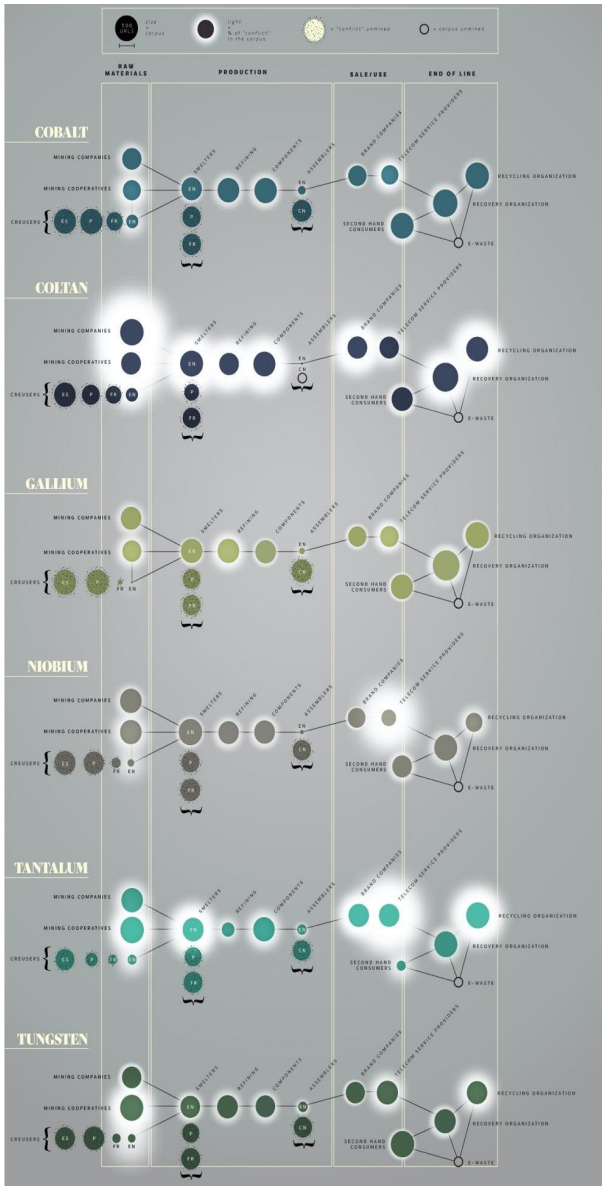



*Figure 16: Visualisation from collaboration with FairPhone.*[41]

[40] Interview, Richard Rogers.
[41] https://wiki.digitalmethods.net/Dmi/DmiSummer2012ConflictedMinerals

It is not just visualisations which are important for slide-making, but also project walkthroughs. Slide deck walkthroughs are a vernacular format that is adopted from the narrative, presentational and professional practices of external collaborators, and repurposed as means of making sense of collaborative research. At the DMI the focus of presenting project outputs is the most significant, interesting and unexpected findings, rather than a step-by-step account of what was done. This has resulted in a conventional ordering of the presentation of projects, which was initially prompted by collaborations with the Open Society Foundations and includes: "their urgency, your question, the map, the zoom in, the findings".[42]

An alternative format for socialising materials from inquiry is the poster session. In the context of scientific conferences, the poster initially arose as a portable, standalone format for communicating research when presentation time was limited (Waquet, 2012). In public settings these printed spreads may also be understood in relation to longer histories of pedagogic exhibitions and displays (Turner 2013). At a recent University of Amsterdam sprint on online disinformation associated with the Ukraine conflict, activists and issue experts were invited to explore and discuss posters in an informal setting.

*Figure 17: Exhibition on disinformation in Ukraine at University of Amsterdam.*

*Annotated visualisations*

As mentioned, visualisations are another output format that may be salient for students, researchers and external collaborators. In the context of digital methods and data research and teaching, visualisations are often exploratory rather than explanatory, and projects aim to "multiply the maps", to create new and experimental formats of visual representation and to enable new perspectives and forms of collective learning (Rogers and Lewthwaite, 2019). Visualisations may serve as elicitation devices with external collaborators and their networks, "part of the research process rather than a culmination or final display" (Figure 18).[43] For example, the European Forest Institute used visualisations and composite images developed with the Public Data Lab, King's

[42] Interview, Richard Rogers.
[43] Interview, Richard Rogers.

College London students and DensityDesign Lab in a series of engagements with journalists and scientists to generate different perspectives on the 2019 Amazon forest fires, which are currently being integrated into the issue mapping.

*Figure 18: Collaborative annotation and interpretation of maps and visualisations at the Global Forum on AI for Humanity.*[44]

Observations may also be layered onto visual outputs in the form of comments and annotations – a process which the médialab have created a dedicated visual software tool to support.[45] Thus, rather than being used as objects to stabilise and communicate certain pre-established representations, visualisations can also serve to surface and multiply perspectives.

*Recipes and "how-tos"*

Another output we've been experimenting with is the "recipe", "how to", or "research protocol".[46] The recipe is a well-known format whose development is entangled with not only the making of food, but also early modern documentation of scientific experiments (Smith et al., 2020). The format of recipe-making is also widespread as a genre of technical documentation, as in the case of programming "cookbooks". We were interested in this approach as it also supports external collaborators to be co-inquirers in the process of using of digital methods and data, rather than just beneficiaries of their results, as well as affirming that digital methods can be useful not just for researchers or students, but for many others who use them in a wide variety of professional and everyday settings. Thus the *Field Guide to "Fake News"* (Bounegru et al., 2018; Gray et al., 2020) and the Infodemic projects sought to produce recipes which could provide inspiration and methodological starting points for researchers, students and journalists interested in investigating

[44] http://www.tommasoventurini.it/ai/
[45] https://medialab.sciencespo.fr/en/tools/tesselle/
[46] At the University of Amsterdam such research protocols are often the operational section of worksheets for students.

misinformation and "information disorder" (Wardle and Derakhshan, 2017). Students wrote up their projects as illustrated step-by-step recipes, which also served as the basis for "Digital Investigation Recipes" co-published with First Draft (Figure 19), as well as another collection published with the Public Data Lab.[47]

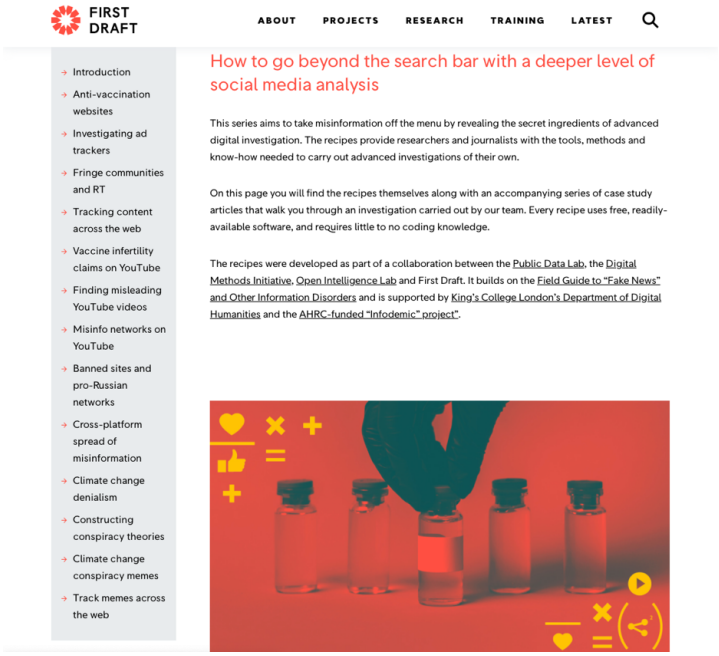



*Figure 19: Collection of "recipes" for digital investigations developed with First Draft.*

*Experimental and hybrid formats*

Digital methods and critical data practice projects may not just work within the conventions of established vernacular formats but may also seek to generate new, experimental formats for digital research – whether art projects, maps, software, guides, dashboards, templates, interactives, prototypes, performances, GIFs, games or video clips. This can involve the "artful crossing of information streams" and the translation and transposition of formats between different areas, such as the "issue ticker" (Rogers, 2004) which used the format of the "consumer price index" to explore the dynamics of civil society issues on the web.[48]

The playful modification, ironic reassembly and critical and inventive repurposing of formats (Lury and Wakeford, 2012; Rogers, 2018) also draws on approaches from art and performance practices. For example, in a project about relations with creatures in cities that Donato Ricci did with the DEPT. group, rather than pre-selecting, filtering and reducing data with maps and visualisations, the organisers printed out "catalogues" of entire social media datasets that they had gathered. These catalogues were used as materials to produce works drawing on the cultural forms – from theatre, radio and acting – that students and participants brought from their backgrounds and training to reperform the posts together (Ricci et al, 2021).[49]

[47] See: https://firstdraftnews.org/long-form-article/digitalrecipes/ and http://recipes.publicdatalab.org/ . Recipes were also used to explore "epistemic keywords" as an entry-point to COVID-19 conspiracies: https://medium.com/1st-draft/finding-misinformation-with-rumor-cues-ee1355fb82ae
[48] http://www.infoid.org/
[49] Interview, Donato Ricci.

Such experimental formats are thus concerned not only with the presentation of outputs, but also the process of involvement of inquiring collectives. Several of Donato Ricci's projects, informed by STS and research on objects and techniques, explore different ways of collectively making sense of and relating to collections of data and media, including through processes such as collage (Ricci, 2019).[50]

## Conclusion

In this article we outlined how students, researchers and various external collaborators may work together on digital methods and data projects with an arts and humanities sensibility. As discussed in the sections above, this may be accomplished by means of (1) a *project brief* indicating starting questions and *problem composition*; (2) a *project setup* such as a workshop or sprint that enables a collective of inquiry to gather, focus and give time and attention to the project over a sustained period; (3) a *project package* including outputs, datasets, diaries, group notes and other materials to be shared with those involved and used as the basis for further writeups, activities or classes (including beginning the cycle again); and (4) an orientation towards *vernacular formats* which may speak to the situations of different participants, including possible "boundary outputs" and experimental outputs that combine or transpose different formats to bring fresh perspectives. The collective of inquiry may thereby look at how digital methods and data may contribute to the recomposition of problems and objects of inquiry. Examining and loosening the weave of problem composition may suggest other threads, other openings, other points of intervention, other actors or perspectives which have been overlooked or excluded.

It is not always easy to organise activities that work well for students, researchers and external collaborators. To accomplish it requires finding alignments and facilitating learning across interests, settings, backgrounds, commitments, working styles and schedules. The process is not always straightforward, and the outcome is often not what was envisaged by those involved. In the four sections above we have presented some of the things which we have learned from our previous work, which might be taken as a gathering of considerations for educators organising collaborative digital projects. The organisation of collectives of learning that involve researchers, students and external collaborators may also contribute to making space within universities and educational institutions for ways of exploring and engaging with public problems and issues. As well as thinking about how digital data and machines can equip researchers, or how the use of data and machines might be broadened or democratised, engaged research-led teaching projects can serve as a way to support collective inquiry and learning about how problems may be understood, articulated and addressed differently by digital means, without taking these means for granted.

[50] Interview, Donato Ricci.

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[51] https://publicdatalab.org/projects/infodemic/

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