

Life After Visualization

How to Recover Data That Eludes Visualization and How to Revive Data That Has Been Made Visual

Margherita Ascari

Alma Mater Studiorum

— Università di Bologna

margherita.ascari2@unibo.it

ORCID 0000-0003-3165-1802

Donato Ricci

Sciences Po

donato.ricci@sciencespo.fr

ORCID 0000-0002-4739-1622

Abstract

The article examines two problems that emerge at the intersection of data collection, processing and visualization with participatory public inquiries. In these contexts, the use of data visualization makes it possible to represent (part of) phenomena of collective interest, and design techniques allow the activation of spaces for mediation with diversified publics. Starting from a critical re-examination of experimental research experiences conducted by the médialab Sciences Po and the Advanced Design Unit at the Università di Bologna, the article proposes a reflection on data participatory practices from a dual perspective: on the one hand, data that is not part of a visualization process and therefore does not enter into collective reflection; on the other hand, how some visualised data is interpreted not only in relation to its content but also to the format through which it is conveyed. The proposed reflections, which connect issues arising from the concept of data and from limitations linked to the concept of civic participation, aim to invite further experiments and lines of research to identify modalities and strategies for mitigating the problems that have been brought to light.

Keywords

Data visualization
Public issues
Collective interpretation
Digital transformation

Introduction

This article explores the challenges that emerge at the intersection of data collection, visualization practices and public participation. Of particular interest is how these challenges arise in contexts where people with knowledge in diverse fields are involved in design processes addressing complex domains. The article focuses on two complementary problematic aspects: first, how visualization processes can lead to the exclusion of meaningful data (elusive data); second, how visualization can result in oversimplifications of the phenomena — or parts thereof — leading to the need and the opportunity to recover them (data post-visualization)¹.

This article arises from a critical (retrospective) re-examination of certain research experiments conducted within the *médialab Sciences Po*². These experiences exposed two unresolved issues regarding research and design moments in which data are addressed through public participation. The analysis of these open issues led to the definition of the specific characteristics of further experiments carried out within the Advanced Design Unit at the Università di Bologna, particularly during doctoral research. These experiments adopted a similar approach while aiming to identify ways to mitigate the problems that were brought to light. This article describes the outcomes of this re-examination and these experiments, as well as the results of a process of abstraction that led to the development of conceptual frameworks based on these problems. The ultimate goal is to extend an invitation to identify new forms, practices, and research lines that address the same problems. The definition of the two problems refers to the contemporary discourse surrounding recent applications that show how adopting approaches, practices, or techniques derived from design research and practice, combined with data-based artefacts, can facilitate public discussion on issues of collective interest. Such processes rely, among other things, on the application of 'design techniques' that mediate between individuals with varying levels of expertise in different domains of knowledge (Celaschi, 2008).

Context

The relationship between design and data has evolved in parallel with the development and acceleration of digitalization. A foundational aspect of this evolution is the relationship between data and communication design, which gave rise to data visualization as the practice of graphically representing structured data in order to communicate it effectively (Masud et al., 2010). The use and processing of data in design disciplines has shown that data visualization not only serves purposes of communication (i.e. marketing), it is also a tool to re-contextualise the content of the data, using data visualization within a process of public inquiry. These processes engage with the descriptions of issues and problems at various scales of complexity (Mauri & Ciuccarelli, 2016; Ricci et al., 2017), resulting in a high degree of variability in their impact, particularly in terms of their capacity to transform the problem being addressed: in other words, the ability of

¹ In this article, when referring to the concept of data, we do not mean only the subject itself, i.e. the codified result of an observation process (whether direct, indirect, physical or automatic), but rather the entire chain that starts with observing a phenomenon and ends with the construction of a dataset, including the methodological, technical and conceptual choices related to observation, organisation methods and choices regarding the storage and dissemination of a dataset. For this reason, the use of formulas that seem to attribute forms of agency to the data itself actually refer to the entire chain, which also includes choices and actions attributable to humans. On the interpretation of data as the outcome of a complex chain and on the use of similar terminology, see, for example, Jungs de Almeida et al. (2024) or Loukissas (2019).

² This work stems from an experience of cross-fertilisation between the two research institutions, originating from a visiting period in autumn 2023 when the author M. Ascari worked with the design team of *médialab Sciences Po*, whose design lead was then and now the author D. Ricci. The article reflects the outcomes of this collaboration and of the ensuing exchange and research activities, with the aim of connecting the reflections of the two laboratories with a broader discourse in the field of design research relating, in very general terms, to the theme of data in design.

a specific public to interpret a visualization depends on how the visualization process — from data to artefact — is designed. Given that the complexity of a visualization depends on the type of data chosen, the formats for creating data-based communication artefacts have expanded and evolved over time, thanks in part to the spread of software that enables data processing and graphic representation (Cairo, 2013). Data visualization is not a recent innovation: its origins can be traced to the development of the experimental method, and its evolution is closely tied to advancements in statistics (Friendly, 2005) as well as the history of the modern era. Re-examining the history of data visualization in relation to, for example, colonialism (Klein et al., 2024) introduces one of the main problematic issues associated with the transformation of data into communicative artefacts: the non-neutrality of both the data (D'Ignazio & Klein, 2020) and the format chosen to communicate them (Cairo, 2019). The matter of data non-neutrality is linked to the fact that although data are generally considered to be 'objective', they cannot be disentangled from the methods defined for observing the phenomena of interest (Daston & Galison, 1992; Iaconesi, 2017). In other words, the logic underlying the structure of a dataset derived from observing a phenomenon can change based on the methodological, technical, and instrumental choices made to measure it. The increasing use of digital systems, including machines and algorithms, has obscured how the human perspective can influence the observation process.

The question of objectivity becomes central when data are part of processes aimed at debating, understanding, and attempting to resolve an observed problem. Partial data representations of a problem can lead to simplistic solutions because digital systems, including algorithms, are not necessarily capable of capturing the complexity of the issues in the world. This is particularly true when the contextual conditions considered during the development of a digital system are modified (Cardon & Crépel, 2019). Examples of the non-neutrality of data derived from the coding of social reality (Bowker & Star, 1999) have been widely debated, for instance, with regard to gender (Criado Perez, 2020), showing how the application of perspectives linked to the masculine gaze — for many years the majority of 'practitioners' in various fields have been males — have impacted strategic, design, and policy choices, because they were based on data collected and used from these unique perspectives. A similar discourse can be applied to dominant visions in general, leading to debates about the application of critical perspectives to data (D'Ignazio & Klein, 2020). Extreme effects of data non-neutrality can also be found in so-called submerged phenomena: phenomena that are not observed, recorded, or translated into data, and thus do not appear in official narratives. A widely discussed example is the issue of femicides and how they are not highlighted in some official databases, leading to actual difficulties in analyzing the phenomenon based on these sources (D'Ignazio, 2024).

The non-neutrality of data should not be considered a problem to be solved but rather an intrinsic characteristic of data itself: the issue is not the non-neutrality per se but the assumption that a data-based artefact, which contributes to knowledge production, is more objective than a non-data-based communicative artefact.

In other words, the issue of data non-neutrality must be considered when evaluating a phenomenon solely through data visualization, as it cannot be considered univocal or objective. That said, visualizations retain their validity as tools for interpreting a phenomenon, which they describe in a coded and synthetic form in order to enable discussions about the phenomenon itself and potentially transform it. In this sense, data visualization has a certain validity in participatory processes in which non-expert stakeholders, affected by and involved in a given problem, are engaged (Marres, 2005, 2007). In this context, it is necessary to examine the relationship between design and participation, understood as the involvement of individuals and communities in a process aimed at achieving a common goal. In the design discipline, the involvement of people other than the designers has, for many years, been linked to the validation of designed artefacts with end users. Since the 1970s, with the evolution and commercialization of digital systems, a growing need has emerged to develop methods that integrate these people more broadly into the design process, as in the case of the widely known user-centered or human-centered paradigms. Although these approaches cannot be defined as participatory per se, the intuition of introducing, at a certain point in the process, an evaluation of the project provided by potential users can be considered a practice that paves the way for subsequent models that effectively consider the dimension of participation within design (Manzini, 2015). Consequently, techniques have been developed to foster involvement that can be applied in contexts beyond strictly design-related ones, such as civic participation or citizen science. The term co-design has been applied over the years to various types of projects across fields such as architecture, urban planning, and public services. It overlaps to some extent with civic participation, i.e., citizens' involvement in strategic, political, or material processes of defining the city. This overlap is of interest because co-design processes, like other participatory forms, are not immune to problems that can undermine the overall purpose of participation. In fact, some critiques has been moved to participatory models, not so much in terms of substance as in the way participation might be implemented.

This paper does not question, and indeed supports the idea that participatory forms are useful for addressing collective issues. This is especially important because the pluralization of perspectives that a participatory process can bring to the table reduces the risk of building exclusive representations of a phenomenon, i.e., representations that do not account for the diversification in the lived experiences of people who could potentially analyse it, or are affected by it. What is discussed is that practices such as data visualization enable participation when they make it possible to compare or at least to debate a phenomenon or a collective issue. What it is acknowledged is that, at the same time, data visualization risks promoting univocal visions if the data itself is approached without considering the issue of non-neutrality.

From Retrospective to the Present Tense

This section defines two problematic aspects ('elusive data' and 'data post-visualization') that emerged from a critical retrospective on experimental works conducted by the médialab Sciences Po, which have led to the definition of further experimentations conducted within the Advanced Design Unit of the Università di Bologna. The critical analysis consisted specifically in reading Sciences Po experiments in light of the contemporary debate surrounding (design) participation and its risks. Indeed, while the experiments at médialab stem from the recontextualization of data visualization practices rooted in traditions related to sociology and, more broadly, the social sciences and humanities (SSH), re-reading this work with a perspective and epistemology more aligned with design research — such as that provided by the Advanced Design framework — made it possible to bring to light certain unresolved aspects which are debated here as a way to invite further research into the same matter. The work of the médialab has, since its foundation, focused on studying how the widespread diffusion and use of digital systems — particularly digital media — transforms social worlds, adopting an interdisciplinary approach that combines expertise from the fields of sociology, computer science, and design (Venturini et al., 2017). The work of médialab, particularly in certain research experiences discussed below, is relevant to address the problematic aspects described in this article, because it provides useful elements for testing how data can intervene in the relationship with the social realm through the application of specific design techniques. In conjunction with the médialab Sciences Po projects, other experiences by the Advanced Design Unit are analysed with the purpose of illustrating the manifestation of the two problematic aspects identified here ('elusive data' and 'data post-visualization'), outlining their features, and presenting some possible resolution frameworks ('recover' and 'revive'). The proposed analysis is based on past experimental experience and its contemporary counterparts.

How to Recover Data That Elude Visualization

This section refers to the problem of 'elusive data', meaning that excluding data from a visualization or communication artefact — whether consciously or unconsciously — creates difficulties in interpreting a phenomenon when the chosen medium is a visualization based on incomplete data. The previous section described how intrinsic characteristics of data, such as non-neutrality in collection, analysis, and representation, can lead to the exclusion of some data from a communicative artefact. Given that this problem is considered difficult, if not impossible, to fully resolve, the work involving the 'tensing techniques' developed at the médialab Sciences Po is of interest as an attempt to overcome this problem by creating opportunities to enrich the data 'after' its visualization. These techniques, derived from design cultures, allow for the extension or enrichment of the representation of a phenomenon, typically an issue or controversy (Venturini et al., 2015), incorporating apparently unrelated

elements that can provide a broader representation useful for building public inquiries around the phenomenon itself (Ricci, 2019). The ‘tensing techniques’ involve several phases: a phase to represent the phenomenon using various data and formats selected via curatorial approaches (corpus), a phase to visually represent the possible consequences related to the phenomenon of interest, and finally a phase to extend and problematize the corpus and its visualizations, including through public participation. In this sense, data visualizations play an instrumental role capable of bridging the gap between the datafied version of a phenomenon — which is technical and not necessarily accessible — and a diversified public, through the construction of specific communicative formats that enable the public itself to critically approach a common issue. Practices and methods derived from design cultures contribute to reducing the gap between qualitative and quantitative methods, producing new graphic forms to visualize a phenomenon both vertically at specific moments, and in relation to its evolution over time³. They then provide tools for creating a ‘public’ called upon to describe and intervene on the phenomenon itself. The idea of starting from a set of visual representations enables discussions that can enrich the initial representations (considered to be non-neutral and derived from a technical perspective) with situated knowledge (Haraway, 1988)⁴ from those who have directly experienced the manifestation of a given phenomenon. In other words, tensing techniques acknowledge the non-neutrality of data and its effects as unavoidable aspects of data construction and communication. Experimental applications conducted by the médialab demonstrate that applying tensing techniques enables the construction of extended, hybrid corpora across content and formats that can represent complex issues in economic, political, and social terms. Examples to which these techniques have been applied range from investigating the material effects of the gig economy, as in the Algog glitch project⁵, to exploring the urban-nature relationship, as in the NATURPRADI project⁶, or examining artificial intelligence as a socio-technical phenomenon, as in the Shaping AI project⁷. The hybrid nature of the corpora stems from the simultaneous use of different data collection methods, including data derived from both direct observation and the use of digital methods (Rogers, 2013), to investigate a phenomenon through its manifestation and dissemination in digital public spaces. The intuition of observing a phenomenon through the way it is disseminated, for example through interactions on social networks, both textual (Ricci et al., 2017) and image-based (Ricci et al., 2021), favours the emergence of ‘intrusion data’, meaning elements not apparently related to the phenomenon of interest but that contribute to showing how it correlates with other social issues. For example, an investigation based on the collection of tweets on the urban-nature topic in the city of Paris revealed a significant recurrence of photographic images containing rats, representing a ‘data intrusion’ useful for showing an unexpected relationship between the greening of Paris and “a wider cosmos of neglected things” (Ricci et al., 2021, p. 9). This example illustrates how radically different interpretations of the same phenomenon (greening) can coexist, ranging from green as an opportunity for greater well-being to green as a potential source of increased public health threats. Such heterogeneous corpora serve

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Examples of such visualizations have been created, for example, in the project EMAPS: <http://climaps.eu/#!/home>

4
The formula ‘situated knowledge’ is used here because it includes the fact that certain forms of knowledge are directly correlated to the perspective of those who produce them. Haraway’s contribution (1988) places situated knowledge in direct opposition to scientific knowledge, criticizing how the latter rely on a claim of objectivity when it is partly influenced by a subjective dimension. The concept is, however, theorized in relation to the context of knowledge linked to the American Feminist movements and studies of the 1980s.

5
<https://medialab.sciencespo.fr/en/activities/algog glitch>

6
<https://medialab.sciencespo.fr/en/activities/naturpradi/>

7
<https://www.shapingai.org/>

as a basis for activating recontextualization processes, inviting the observing public to indicate what is missing, what is excessive, and what can be modified based on their personal experiences in relation to the phenomenon of interest. Beginning with an explicitly unfinished corpora simplifies the possibility of introducing changes or new elements. In other words, the consideration of different ways of understanding and perceiving the same phenomenon is included in the process by design. These techniques are relevant to addressing the problem of 'elusive data', because they allow for building representations of a phenomenon or an issue derived from processes of observing, collecting, and recontextualizing data that can potentially involve subjects with very diverse perceptions of the same phenomenon. After all, these techniques are open, their application can lead to significant variability depending on the context. On the one hand, adopting curatorial and participatory approaches to define datasets helps to mitigate bias by incorporating multiple perspectives into the data and their derived representations. On the other hand, it may prove difficult to compare the outcomes of these processes with other sources that ultimately describe the same phenomenon, albeit more generally. Two matters remain unresolved in the application of 'tensing techniques'.

First, the 'situatedness limit': although the investigation protocols associated with tensing techniques are codified, they present a certain degree of customization due to their curatorial and open nature. For example, anticipating from the outset the possibility of enriching the dataset with 'intrusion data' requires the investigation to be adapted in response to unexpected results. Similarly, the processes of recontextualizing datasets based on public interrogation inherently require opening the investigation to unforeseen results. While these are generally considered risks worth taking to obtain multiple perspectives that can reveal additional facets of the same complex issue or phenomenon, they can also create obstacles to scalability and to applying the same to other problems and contexts.

Second, the 'knowledge domain limit': although the application of 'tensing techniques' favours the discussion of a phenomenon in a participatory context, the way that they can be applied does not necessarily resolve issues of accessibility to participation. They involve introducing a more or less diverse public to a collective issue by creating spaces for encounter between the public and different types of representations derived from the initial corpora. In other words, the phenomenon is observed critically, collected into a heterogeneous corpus. The corpus is represented through visual formats, and these formats are proposed as an interface to initiate public discussion. This type of process requires the identified public to negotiate how the visual formats and the content of the corpus adequately represent the phenomenon in relation to individual perception. To do this, the public involved must: A) be affected by the issue of interest and motivated to discuss it; B) have time and energy to dedicate to the negotiation process and thus to individual reflection; C) possess a level of digital skills sufficient to understand the origin of the observed corpus, proportional to the complexity inserted into the data visualizations used to convey the corpus/phenomenon itself.

Building on the identified limits, possible strategies to advance the application of ‘tensing techniques’ should include:

- A Regarding the first point, while acknowledging that the motivations for participating in a participatory reflection process are generally varied (Raddick et al., 2013), it is considered essential to encourage involvement as openly as possible, including building systems to foster a shared literacy around the collective issue of interest in the public engaged in the experimentation. These systems should promote participation by making individual motivations visible. They should be considered living tools, modified to reflect the characteristics of the subjects in the public of reference.
- B Regarding the second point, it is considered essential to create flexible discussion spaces, considering that the ability to dedicate time to activities other than work, personal responsibilities (e.g., care work), and a certain amount of leisure time varies significantly on the basis of socio-demographic characteristics (gender, age, economic status, physical location).
- C Regarding the third point, it is essential to identify spaces that can help facilitate the transfer of the digital skills required to evaluate the corpora and data visualizations within a participatory context. Given that, at least in the EU, the lack of digital skills is significant⁸, the requirement for a minimal understanding of the mechanisms underlying a discussion process on a phenomenon represented digitally (through a set of data visualizations) constitutes an important criticality when applying these protocols to issues affecting a diverse public.

A first empirical attempt to include these elements took place during the development of the *Collective Archive for Climate Emergency Memory* (CACEM) research project which, drawing on results and techniques originated from the experiences of the médialab, proposes a series of methods useful for mitigating the limits defined above. The project, conducted by the Advanced Design Unit and currently in its early stages, aims to build an extensible archive of qualitative and situated data, particularly testimonies, narratives, and reflections related to the effects of climate emergencies. An initial experiment was conducted in Faenza, as part of the DIG-UP⁹ program, on the theme of the floods that affected the Emilia-Romagna region (Italy) during 2022–2024. The project is centred on the creation of an archive and workshop-based meetings aimed at citizens. In this case, the ‘situatedness limit’ was addressed by choosing to use tools with codified interaction modes — in this case based on Google — for data collection and for the construction of a modular structure that would make it possible to adapt the tool and protocol to different contexts from the design stage onwards, providing the possibility of integrating and comparing different data types, contents, and visualizations within the same environment Fig. 1. The ‘knowledge domain limit’ was addressed by creating meeting spaces (workshops) in which data collection was combined with opportunities for the transfer of digital skills and for a collective discussion of the issue in question Fig. 2. In this case, the visualization of the archive itself promotes moments of both individual reflection — in which participants are asked to identify elements in the narrative about the climate emergency — and collective discussion, prompted by the co-constructed archive at the end of the meeting.

⁸ According to the DESI Digital Index, the percentage of individuals in Europe with “at least basic digital skills” is 55.56% (2024), while those with “above basic digital skills” is 27.32% (2024). More information here: <https://shorturl.at/pVV0g>

⁹ DIG-UP is a digital culture program promoted by the University of Bologna and the Unione dei Comuni della Romagna Faentina. The project aims to enhance digital literacy and citizens’ inclusion through a challenge-based approach and the organization of events dedicated to students, public and private actors in the Faenza, Italy, territory. <https://shorturl.at/AVdJO>

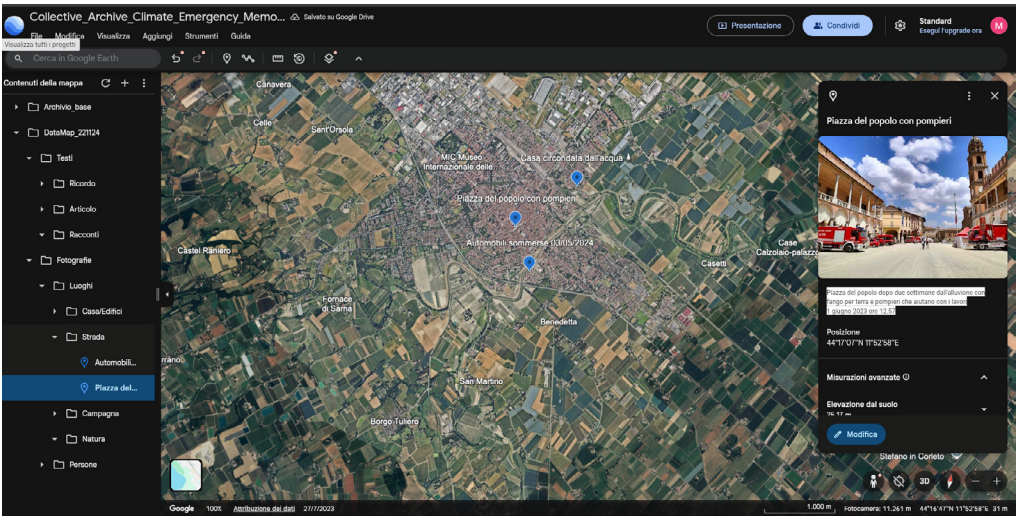


Fig. 1
CACEM Archive prototype showing a data point (photo and description) produced by participants in the first experimentation (Credits: Advanced Design Unit).

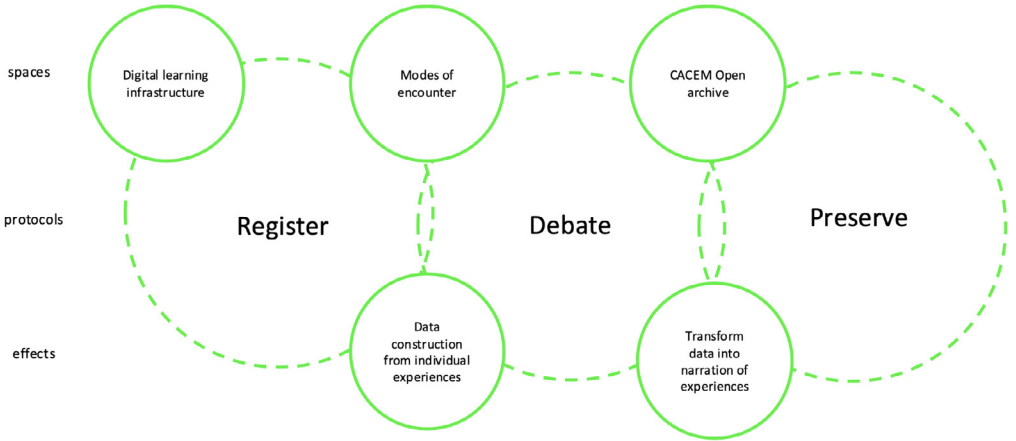


Fig. 2
Experimental design of the CACEM research project (Credits: M. Ascari, S. Colitti).

This section addresses the problem of ‘data post-visualization’: visualization processes involve flattening, on the one hand, and the reinterpretation of the data itself on the other, leading to problems when such visualizations are used as the sole means of interpreting a phenomenon. Section 1 presented how a problematic aspect emerging at the intersection of data, design, and participation is that data visualizations can only be partial representations of the data itself. This is because the process of translating a dataset into a communicative artefact involves making choices about content analysis and prioritization, as well as formats and graphics. These choices are attributable to the designers who materially carry out this transformative process. Although this characteristic of the process allows for the construction of multiple visualizations of the same dataset — and thus for representing different aspects of a given phenomenon — it is also true that making choices determines the introduction of defined perspectives that result in focusing the gaze only on certain aspects considered priorities. This matter risks limiting the observed phenomenon to a partial visualization, which is considered problematic when the visualization is proposed as an element of negotiation with a public that is external to these design choices.

There are two dimensions to this problematic aspect: the first is that whenever a phenomenon is transformed, flattening occurs. This means that a phenomenon or issue that manifests in the physical or social world is more complex than a dataset representing that phenomenon, because the very act of conducting data collection involves defining parameters and constraints that exclude certain aspects of the problem. Similarly, a dataset representing that phenomenon will be more complex than a visualization of it, because transforming the dataset into a visual format involves defining parameters to prioritize certain aspects over others. This flattening occurs because it is not possible to create a digital copy identical to a phenomenon occurring outside digital spaces. This flattening can be seen as an opportunity to focus on specific aspects deemed to be priorities within specific contexts, but it still poses a risk, mainly because it can be used to deliberately hide certain aspects (Cairo, 2019; Kennedy et al., 2020).

The second dimension is that, even when addressing the issue of flattening critically, the choice of visual format shapes how a specific public perceives the content. To extend this concept, it is helpful to reflect on the work conducted by the médialab within the AIME project¹⁰, which introduces a set of reflections on how ‘formats’, understood as vehicles of the content, influence the understanding of the content itself, as well as how the definition of a specific format determines precise expectations about the conveyed content. The AIME project (2012–2014) was a philosophical investigation aimed at answering the question “how can we compose a common world” by redefining the concept of ‘modernity’. Within this project, a reflection on academic formats for research dissemination (e.g., articles, monographs) was introduced. The discussion focused in particular on how these formats can create frictions or misalignments among users, because the same format can be used or interpreted differently (de Mourat et al., 2020). An example is the concept of an ‘academic book’, understood as both the physical book itself and a set of digital files uploaded to the same repos-

¹⁰
<http://modesofexistence.org/>

itory, which can be accessed separately. The fact of accessing the same content in different ways influences how the content itself is perceived: “The format of an artefact generally refers to its size and shape, but also to its layout and technical structure [...] it also orients and conditions certain modalities of reading, writing, arguing, reflecting, and speculating” (de Mourat et al., 2020, pp. 103). The project experimented with building a publication infrastructure for the project based on different ‘editions’ — including a printed document, various digital applications, as well as workshops and meetings - to convey content to a transdisciplinary public, composed of academics and practitioners from different disciplines and backgrounds. It is argued that the more a format is open to diverse modes of use, even at the risk of generating misalignments on how the content is understood by different subjects, the more varied elaborations on the same content can emerge.

The AIME experience shows how different people can use the same content; leading to diverse reflections and, in turn, diverse knowledge. While this is a positive factor, it can also be a limitation. The ‘misalignment limit’ refers to the fact that the use of different languages and registers — determined in this case by different disciplinary backgrounds — can lead to different expectations that may be disappointed if the form differs from what was initially intended, resulting in different modes of understanding the same content. The risk is that the use of a specific format may favour use by subjects already accustomed to it, limiting the possibilities for those who are not. This discourse about formats and their characteristics has been applied to other experiments at the médialab, more closely linked to data visualization¹¹: applying this discourse to the issue of data visualization is of interest because the same content (data) can be conveyed through a variety of different formats, which can differ, for example, in terms of interaction modes (static/dynamic), materiality (physical/graphic/digital), content density, and narrative tone.

To consider the ‘misalignment limit’ in the context of a visualization process involves developing strategies that acknowledge that formats are not neutral containers but rather vehicles of use modalities that vary according to demographic factors. This is particularly important when the data visualization tool/artefact is chosen to build collective knowledge, in which the formats favour the identification of common languages shared by the public standing around the same phenomenon. Within the debate on formats and their openness, an experiment was conducted as part of doctoral research at the Advanced Design Unit, focusing on the problem of climate change and the climate risk posed by heatwaves. One of the objectives of the research was to evaluate how to develop representations of the problem that could capture the perception of it by the local population, with reference to the city of Bologna, Italy. One of the main challenges was connected to the fact that the general problem of climate change presented such a degree of complexity — in terms of causes, effects, and impacts on subjects and communities that varied in socio-economic and demographic terms (Berberian et al., 2022; Desai & Zhang, 2021; Ngcamu, 2023) — that it became overly ambitious, if not impossible, to attempt to represent it extensively and generally through the use of a single format. For this reason, the decision was made to adopt an approach based on the definition of different data collection systems and the construction of different

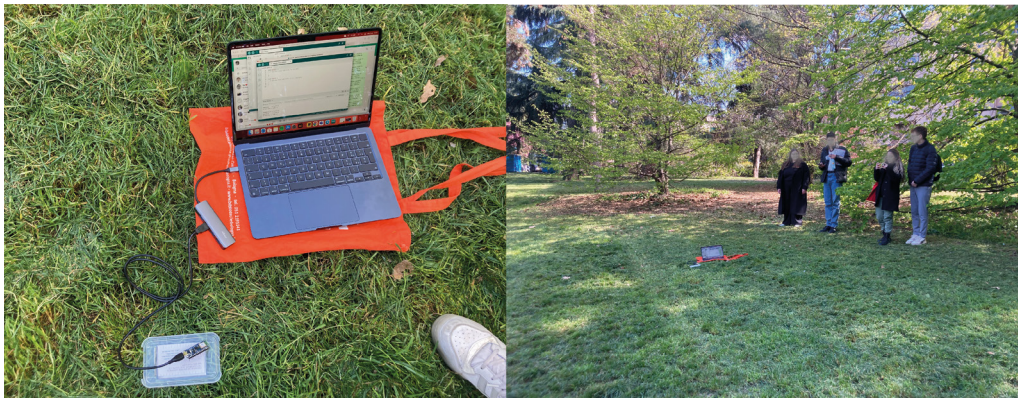
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As in the case of DEPT.
project, which is
described in Ricci et al.
(2017)

artefacts that illustrated complementary aspects of the problem, using data and formats referred to different scales (local/city – national).

- The collection of quantitative data (e.g., temperature, humidity) through the installation of site-specific sensor-based monitoring systems, in collaboration with the Horizon 2020 ReSET project (Mulligan et al., 2021).
- The collection of individual perceptions — in the form of qualitative and textual data — from citizens of the city of Bologna.
- The study of how the topic of climate change and heatwaves was represented in the local press, particularly to evaluate the terms and registers proposed in newspaper articles.

These three lines of inquiry led to the construction of diverse datasets which then underwent interpretation processes with citizens Fig. 3 aimed at evaluating how the phenomenon is represented and to what extent these representations are considered adequate in relation to the individual perceptions of the subjects involved.

Fig. 3
An example of a process of data collection during a workshop for design students (Credits: M. Ascari).



Workshop-based forms were adopted to evaluate the data conveyed through different formats (such as datasets, static visualizations, and network visualizations). The interpretation sessions were combined with data literacy sessions to understand the mechanisms underlying data collection and to identify common lines of understanding. As part of the final experiment *What does climate change mean to me?*, which involved 46 student citizens of the city of Bologna, participants were asked to individually reflect on a visual artefact based on textual data derived from the debate on climate change in the local press Fig. 4 and to produce alternative visual representations of the problem, including their personal perspective.

The application resulted in the construction of 46 alternative representations Fig.5 of how the participating public perceives the phenomenon of heatwaves and the problem of climate change. The set of representations helps describe the complexity of the problem and highlights how, in many cases, there are dissonances between what is a — partial — representation of the debate on climate change in the press and the individual perception one can have of the same problem. When the graphic representations were subjected to interpretation by the students, allowing them the free-

Conclusions

This article has presented two problems connected to the application of data visualization processes in contexts of public participation. The analysis presented here stems from a research experience that connected institutions representing distinct research traditions: one more closely aligned with SSH, the other with design research. This point is highlighted because the definition of the two problems – ‘elusive data’ and data ‘post-visualization’ – shows that the core issue of the reflection must be to find a common language that can help to activate processes of data translation and their visualizations that are more responsive to individual and collective needs. The experiments analysed within this article demonstrate that the topic of what everyone ‘means’ when engaging with data, formats, visualizations or phenomena themselves can vary significantly. While acknowledging that public participation is essential for addressing common problems, as it enables the involvement of those directly affected by a phenomenon, the proposed reflection considers that contemporary modes of participation present some risks. Among others, participation can be affected by participation washing, defined as the practice of activating forms of participation that do not substantially influence decision-making processes but facilitate obtaining a consensus on a specific project (Mattern, 2020). Other risks include the possible — even if unplanned — exclusion of vulnerable or marginalized population groups facing certain types of barriers (e.g., linguistic, skill-related, socio-economic, etc...) (Khairunnisa et al., 2021), risks related to the need for motivation to participate in certain processes (Raddick et al., 2013; Lakomý et al., 2020), or the risk associated with the notion of participation as work (Sloane et al., 2020), where participation serves as a means to obtain data or information for a project without compensation. In the analysis provided, the conceptual friction between what is meant by ‘data’ and what it actually embodies emerges as a recurring theme, as does the fact that the adoption of open formats — rather than fixed artefacts — can lead to innovative practices both in highly codified contexts and in more diversified contexts. In the proposed experiments, data is configured as a mode of translation at multiple levels: from the reality of a phenomenon to its representation in data, from technical interpretations (such as analytical visualizations) to communicative ones, to the critical reflections that arise from them. However, the very definition of ‘real phenomenon’ and the negotiation of what is included or excluded from this category raise crucial questions, especially when read in light of data non-neutrality and the processes of categorisation, storage, and visualization. In this sense, the heterogeneous set of proposed design techniques constitutes a critical practice capable of exposing the epistemological and political conditions underlying an absence of data, especially when it concerns cultural memories, intangible heritage, or minority narratives. The proposed alternatives — such as infrastructures for participatory negotiation, experimental archives, or processes for constructing open formats — contribute to identifying possible trajectories for research on the mediation between different knowledge domains, and at the same time contribute to the need to invite the broader research community to consider the problems identified here in new research efforts.

Margherita Ascari
She is postdoctoral research fellow at the Advanced Design Unit, Department of Architecture, Alma Mater Studiorum — Università di Bologna. Her research interests include the relation between design and STS, particularly how data-mediated design practices can act into processes of co-production of research and co-design of services within urban systems.

Donato Ricci
He is the head of design research at the Médialab Sciences Po, where he develops experimental methodologies, protocols, and artefacts to encourage public participation, collaboration, and engagement. His current research integrates inventive methods and practice-based approaches to tackle challenges posed by environmental transformations and computational technologies.

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