

# A field guide to visualisation-supported information disorders for Media and Information Literacy

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[doi.org/10.21606/iasdr.2023.786](https://doi.org/10.21606/iasdr.2023.786)

This paper describes a doctoral research project that investigates the interconnections between the biased nature of information visualisations, the circulation of information disorders on social media platforms, and the consumption of information during societal crisis situations. The object of the research is a field guide that categorises deceptive information visualisations that circulate on social media platforms during such crises *a priori*, resulting in a twofold contribution to knowledge. Firstly, it systematises existing knowledge in the field of information design, and secondly, it provides a novel educational resource to support Media and Information Literacy initiatives and curricula.

**Keywords:** *information visualisation; information disorders; MIL; social media platforms*

## 1 Introduction

### 1.1 Social media platforms as news sources during social crises

The framing intended for the word “social media” in this research links back to the concept of “phenomenon” (boyd, 2015), referring to an array of tools, rituals, and cultures that emerged with the social turn enabled by the rise of “web 2.0”. Such a phenomenon shaped a critical shift in communication, interaction, and information dissemination (Cinelli, 2020) to the point of becoming pivotal in contemporary society (boyd, 2015).

With regard to the dissemination of information, social media facilitate access to various forms of news, ranging from tabloids-like ones to health communications and more serious topics. Specifically, during times of social instability (Westerman et al., 2014), their use as news sources intensifies. The Covid pandemic demonstrated this pattern: an unprecedented amount of content became accessible (Cinelli et al., 2020; Depoux et al., 2020; Goel et al., 2020), leading the pandemic to be the first “datadriven” (Innerarity, 2021).

During such social crises, the circulation of information visualisations is becoming similarly ubiquitous. As for Covid (Drucker, 2020) and the Russo-Ukrainian conflict (Fafinski, 2022), the number of maps



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and charts is growing exponentially, being used to understand complex conditions and predict future outcomes. Given the complexity and extent of information pollution in digital environments (Wardle & Derakhshan, 2019), this circulation has the potential risk of exacerbating the dissemination of persuasive or deceiving content. Just like words, information visualisations are “tropes” (Haraway D., 1988), which engender “a narrative experience” (Segel et al., 2010) that may not be politically neutral (Boehnert J., 2016).

## **1.2 Information disorders and media and Information literacy**

The term “information disorders” serves as a comprehensive expression referring to a wide range of information pollution types, including misinformation, dis-information, and mal-information (Wardle & Derakhshan, 2019).

The prevalence of these disorders within digital media poses a severe threat to democratic societies (Rogers, 2023), and one case in point is the USA Capitol Hill riots in 2021. Instances like these highlight the importance of citizens being conscious of the potential consequences of their engagement with online media to protect and uphold their fundamental rights.

This research focuses on Media and Information Literacy (MIL) as a proactive approach to providing citizens with the necessary skills to access, analyse, create, and evaluate media content, thereby ensuring the freedom of information and expression. The aim is to support critical responses to media and the digital ecosystem, drawing attention to the production and circulation of visual information, and encouraging scepticism. By integrating the MIL framework with educational resources on the risks posed by misleading information visualisations circulating on social media platforms, the scope of MIL initiatives is empowered on a new level, considering the crucial role of information visualisations in information consumption.

## **2 Methodology**

Based on a critical analysis of case studies and prior knowledge from the fields of information design, media studies and social sciences, the research aims to outline a field guide of deceptive information visualisation circulating on social media platforms during societal crises, which can extend the scope of the MIL framework (UNESCO, 2013) to Data Visualisation Literacy. The goal of the field guide is bifold:

1. To organise existing knowledge on the topic and introduce novel perspectives arising from the circulation of information disorders on social media platforms, exacerbated during societal crisis situations;
2. To serve as educational material for supporting new pedagogical strategies that address the problem of visualisation-supported “information disorders” (Wardle & Derakhshan, 2019).

Such objectives outline the interdisciplinary extent of the research, which follows a Mixed Methodology approach, and is organised as depicted in Figure 1.

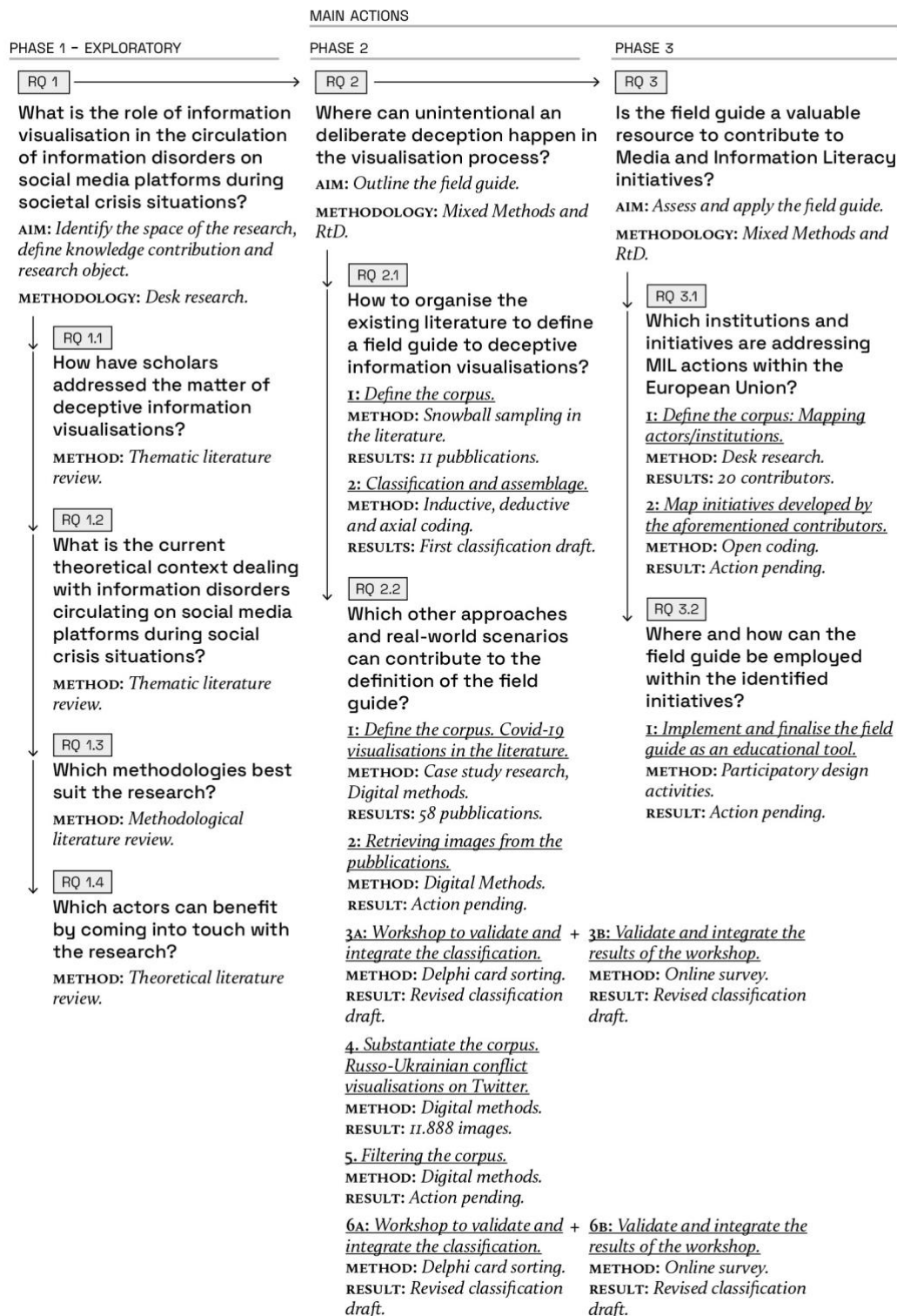


Figure 1. Diagram of the research questions, with aim, methodologies, and methods. By the author.

## 2.1 RQ 1. What is the role of information visualisations in the circulation of information disorders on social media platforms during societal crisis situations?

The first action in the research process is the literature review, articulated around four stages<sup>1</sup>, as shown in Figure 2.

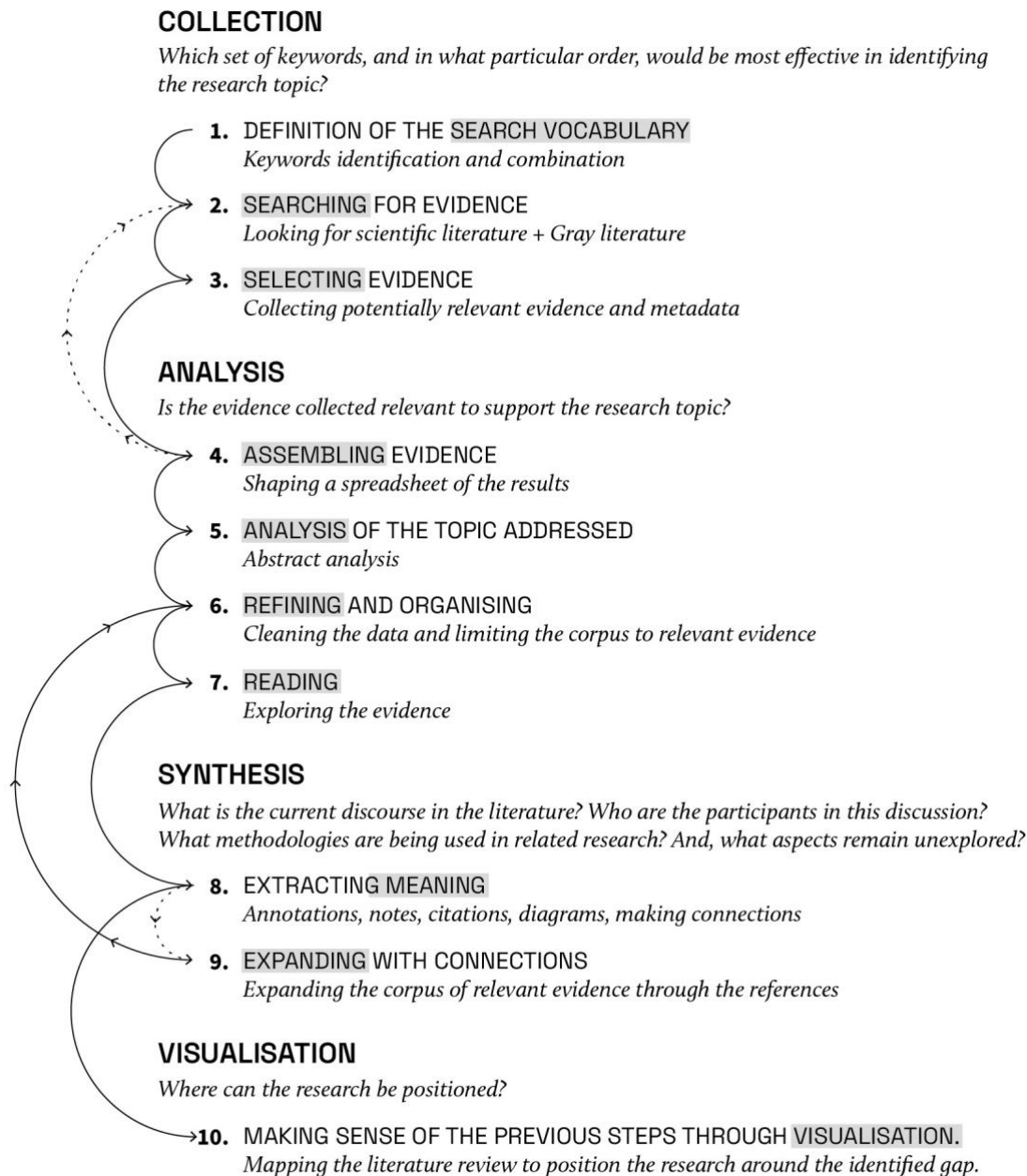


Figure 2. Diagram of the process of literature review. By the author.

Through Desk Research, the aim is to establish the groundwork for the research by exploring theoretical perspectives and case studies pertinent to the issue at hand (Leedy & Ormrod, 2010). The

<sup>1</sup> The definition of the different stages draws inspiration from the five-stages method of Grounded Theory (Wolfswinkel et al., 2013).

final result is a positioning map visualising the extent of the research (refer to 3.1 Literature review) and the void for possibilities: a space for reflecting on the importance of new literacy initiatives fostering critical approaches to information visualisation that circulate through digital environments.

### 2.1.1 RQ 2. Where can deliberate and unintentional deception happen in the visualisation process?

This phase aims to categorise deceptive tactics in the visualisation process. Drawing from the Research through Design approach (Stappers & Giaccardi, 2017), the categorisation is the core centre of the research, forming the foundation for the field guide to visualisation-supported information disorders.

### 2.1.2 RQ 2.1. How to organise the existing literature to define a field guide to deceptive information visualisation?

Focusing on Case Study research (Yin, 2018) with a particular emphasis on “Documentary Evidence” (Muratovski, 2016), the aim is to outline the structure of the field guide through the following steps:

1. Define pertinent literature addressing deceptive information visualisations. Method: snowball sampling starting from three relevant authors (Cairo, 2019; Tufte, 1983; Huff, 1993);
2. Systematise and define categories from the literature. Method: inductive and deductive coding.
3. Compare, systematise, and merge the previously identified categories. Method: axial coding.
4. Validate the first draft structure of the field guide with participants of heterogeneous expertise on the topic. Method: Delphi card sorting to discuss the logic of categorisation, the language used, and the facets identified.

This process draws inspiration from Lo, L. Y. al.'s (2022) proposed taxonomy of misinformative visualisations.

## **2.2 RQ 2.2. Which other approaches and real-world scenarios can contribute to the definition of the field guide?**

This stage aims at substantiating the structure of the field guide with real-world case studies. On the one hand, the collection regards visualisations about the Covid pandemic labelled deceptive in the literature, while on the other, information visualisations about the Russo-Ukrainian conflict circulating on Twitter during the first week of the conflict. The methods employed stem from the Digital Methods toolkit for both gathering and analysing data available on social media platforms. In this phase, it is crucial to consider information visualisations as networked images (Niederer & Colombo, 2018), that cannot be analysed ignoring their circulation. The collected case studies will be part of different validation moments, as shown in figure 1. At this stage, the final output is a taxonomy-like<sup>2</sup> assemblage of deceptive information visualisation considering: established theories, potential motives of deception, the context of circulation, and the effects of crisis situations.

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<sup>2</sup> The classification aims to demystify the issue and facilitate the development of new theories, in line with the definition of taxonomy introduced by Doty and Glick (1994).

### 2.3 RQ 3. Is the field guide a valuable resource to contribute to Media and Information Literacy initiatives?

The third and last phase aims at comprehending how to employ the field guide to support MIL initiatives addressed to visualisation producers.

#### 2.3.1 RQ 3.1. Which institutions and initiatives are addressing MIL actions within the European Union?

Following the methods undertaken for performing the literature review in phase 1, at this stage, the research addresses activities of in-depth studies to map existing MIL strategies, the actors involved, and their success in enhancing societal resilience against rapidly evolving disinformation threats. The final output will serve as a founding basis for comprehending in which scenarios the field guide can be employed as an experimental tool for supporting literacy.

#### 2.3.2 RQ 3.2. Where and how can the field guide be employed within the identified initiatives?

All the knowledge explored in the previous phases triggers the last steps in the research path: the design of appropriate, robust and innovative educational strategies for the field guide to be used by educators as a resource for potential visualisation producers. The approach is that of design as a translation discipline: a mediating and accessing device between a set of content and the final audience (Zingale, 2016). While the definition of the activities for this stage remains general, participatory design activities (such as focus groups and card sorting) involving MIL experts are intended to be conducted to achieve the aim.

## 3 Results

The attainment of expected outcomes follows a three-stage process (refer to Figure 3), with the research currently in the second phase.

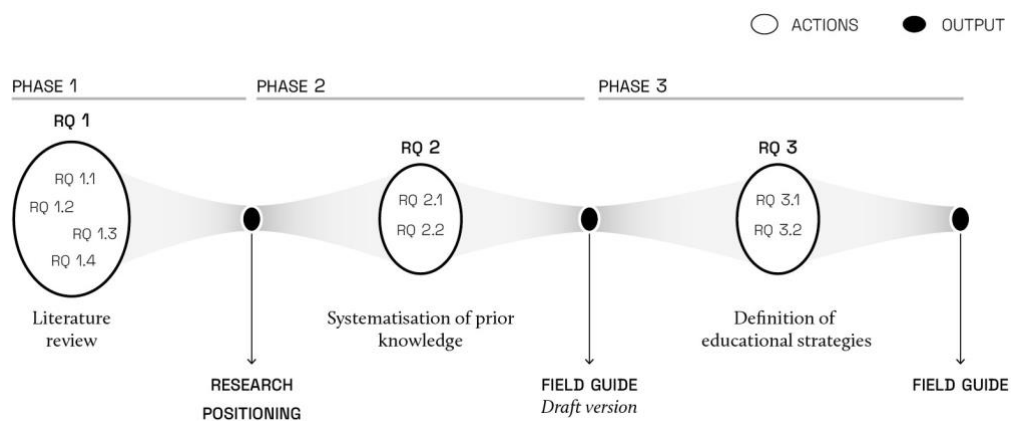


Figure 3. Diagram of planned actions and expected results. By the author.

### 3.1 Literature review

The research derives from the intention of exploring the relationships between: the un-neutrality of information visualisations, the circulation of information disorders on social media platforms, and the complexity generated during “societal crisis situations”. The latter refers to the definition offered by Prooijen et al. (2017):



Figure 4 shows the final corpus of relevant *concepts* arranged into disciplinary fields. Each concept is not limited to a single paper but can reflect the studies of various authors. These concepts are fundamental for the research: by juxtaposing, merging and confronting them the research aims to fill the gap previously mentioned. Given the high degree of similarity between the concepts tackled by different authors, these are clustered as follows:

### 3.1.1 Terminologies

- Information disorders on social media platforms. Social media environments provide a fertile ground for information disorders to thrive since they enable “virality” (Nahon & Hemsley, 2013): the spread of information within diverse and far-reaching networks of users, “resulting in a sharp acceleration in the number of people who are exposed to the message” (ibidem). These new “dominant infrastructural and economic models” (Helmond, 2015), favour what Castells (2009) calls “mass-self communication” to the extent that “an individual user with no track record or reputation can in some cases reach as many readers as Fox News, CNN, or the New York Times.” (Allcott & Gentzkow, 2017). The authors in this cluster discuss the disorders of information from different perspectives, using concepts like “junk news” (Venturini, 2019; Rogers & Niederer., 2020), “infodemic”, “participatory propaganda” (Wanless & Berk, 2018), “conspiracy theories” (De Zeeuw et al., 2020), and fake news.
- Deceptive information visualisations. From this cluster emerges a dense heterogeneity in the definitions conceived and the lack of a common vocabulary when referring to the unneutrality of information visualisations. Some examples may be “counter visualisations” (Lee et al., 2021), “misleading visualisations” (Tufte, 1983; Cairo, 2015), “crisis visualisations” (Zhang et al., 2021), “visualisation mirages” (McNutt et al., 2020), “vernacular visualisations” (Hemsley & Snyder, 2018), and “black hat visualisations” (Correll & Heer, 2017). Moreover, a number of authors use the Covid pandemic as a case study to explore how disruptive events can exacerbate the problem of misleading visualisations.
- The rhetorical power of visualisation. This cluster touches on different disciplinary fields that approach information visualisations as “rhetorical instruments” (Campbell & Offenhuber, 2019) , providing “a single translation of reality” (Kosminsky & Seeler, 2019). Examples include data journalism, which has seen an increase in integrating data representations into narratives (Campbell & Offenhuber, 2019), and semiotics, which emphasises the communicative properties of visualisations (Bertin & Berg, 2010) and the impact of design choices on interpretation (Burgio, 2021). To summarise, the analysis revealed that the message delivered by a visualisation results from a long progression of contexts and decisions, spanning from the initial data collection to the eventual literacies and assumptions of the readers.

### 3.1.2 Theoretical approaches

This cluster comprises those approaches dealing with the politics and ethics of representation in terms of transparency of processes and intentions. One example is Critical InfoVis (Dörk et al., 2013), which delves into the implications of information visualisations. The aim is to “initiate a constructive discussion among researchers and designers about the power of information visualisation”. In a similar fashion, feminist studies (D’ignazio & Klein, 2020) highlight the dearth of critical dialogue concerning



the politics and ethics of representation. The cluster also includes those authors researching and advocating for various kinds of literacies (i.e. visual, information, media). An excellent example is the Media and Information Literacy (MIL) framework, which is fundamental for defining the potential audience of the research.

### 3.1.3 Methodologies

The overarching approach is pragmatic, considering knowledge as the result of an iterative process which can be both qualitative and quantitative. Therefore Research through Design directs the entire research towards a designerly inquiry with the aim of producing an artefact that promotes societal change. The latter, combined with the exploration of an issue which is socially shaped, addresses the research towards the case study approach (Law, 2015) of Science, Technology and Society (STS). Finally, digital methods (Rogers, 2013), focus on “the study of societal change and cultural conditions with online data”.

## 3.2 A field guide to deceptive information visualisations

Academic and grey literature discussing deceptive information visualisations is abundant and various. From Tufte (1983) to Mononier (1991), Correll (2017, 2020, 2021), and Makulec (2020), the issue has largely been discussed and analysed, resulting in a plethora of various definitions and perspectives on the same topic. Such availability highlights the need for a common language, in the potential guise of a field guide, useful for promoting literacy and supporting critical approaches.

With this doctoral research, the intention is to categorise deceptive visual representations based on their final output, to recognise deceptive tactics a posteriori. In this regard, Tufte (2006) defines the process of representation as a grey area, influenced by all those decisions that lead to the final product.

*"Between the initial data collection and the final published report falls the shadow of the evidence reduction, construction, and representation process: data are selected, sorted, edited, summarised, massaged, and arranged into published graphs, diagrams, images, charts, tables, numbers, words."*

With deceptive tactics, this study refers to those actions that can be both intentional and unintentional. While philosophers are divided between considering deceptive as potentially inadvertent (Chisholm and Feehan 1977; Gert 2005) or strictly intentional (Barnes 1997; Faulkner 2013), my position holds both beliefs. To cite Chisholm and Feehan (1977, 145), to deceive means:

*"To cause another person to acquire a false belief, or to continue to have a false belief, or to cease to have a true belief, or be prevented from acquiring a true belief, or to allow another person to acquire a false belief, or to continue to have a false belief, or to cease to have a true belief, or be prevented from acquiring a true belief"*

with no distinction on whether there happen to be specific intentions behind it.

Currently, the research efforts are directed towards collecting and organising how the following authors tackled deceptive visualisations.

Table 1. Corpus of prior knowledge to be systematised for building the field-guide.

Author	Title	Year	Type
Cairo A.	How charts lie	2019	Book
Tufte E.	The visual display of quantitative information	1983	Book
Huff D.	How to lie with statistics	1954	Book
McNutt A., Kindlmann G., Correll M.	Surfacing Visualization Mirages	2020	Conference paper
Correll M.	Towards a Theory of Bullshit Visualization	2021	Journal article
Pandey A. V., Rall K., Satterthwaite M. L., Nov O; Bertini E.	How Deceptive are Deceptive Visualizations?: An Empirical Analysis of Common Distortion Techniques	2015	Conference paper
Lo L. Y., Gupta A., Shigyo K., Wu A., Bertini E., Qu H.	Misinformed by Visualization: What Do We Learn From Misinformative Visualizations?	2022	Journal article
Bergstrom C. T., West J. D.	Calling bullshit: the art of scepticism in a datadriven world	2021	Book
Lisnic M., Polychronis, C., Lex A., Kogan M.	Misleading Beyond Visual Tricks: How People Actually Lie with Charts	2023	Conference paper
Bresciani S., Eppler M. J.	The Pitfalls of Visual Representations: A Review and Classification of Common Errors Made While Designing and Interpreting Visualizations	2015	Journal article
Howard Wainer	How to Display Data Badly	1984	Journal article

A further step in the definition of the field guide is the exploration of literature on deceptive information visualisations circulation on social media platforms during the Covid pandemic. Several studies (e.g. Shelton, 2020; Correll, 2020; Makulec, 2020; Schneiderman, 2020; Doan, 2021) explored the visualisations part of the Covid *infodemic* (WHO, 2020) using various methods and yielding different results. Currently, I am collecting examples of misleading visualisations from a corpus of 58 publications, which will then be integrated into the field-guide.

Figure 5 illustrates a partial view (23 out of 58) of the corpus of evidence analysed. Preliminary findings indicate that the literature frequently employs a limited set of recurring examples. Moreover, despite the online circulation of the information visualisations analysed, only a few studies reflect on the influence of social media platforms in their dissemination.

In parallel, I am investigating a dataset of information visualisations shared on Twitter during the first week of the Russo-Ukrainian conflict. To collect, analyse and process such data, I employed Digital Methods, and in particular, the 4CAT Capture and Analysis Toolkit (Peeters S. & Hagen S. 2022). One random sample (6881 images) of the total corpus is shown in Figure 6. The aim of this exploration is to identify whether the information visualisations collected happen to be deceptive and where they can be positioned within the aforementioned taxonomy, as well as to understand the motives and effects of their circulation on social media platforms.

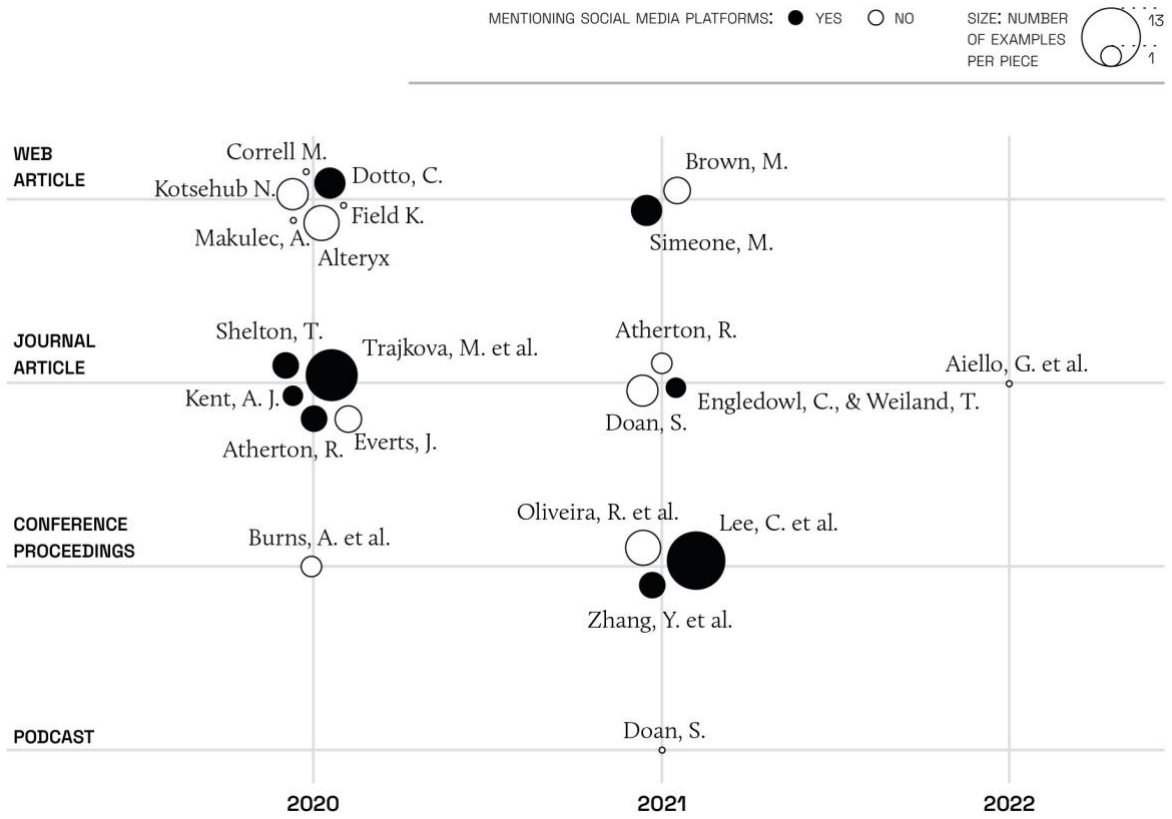


Figure 5. Authors exploring information visualisations circulating during the Covid pandemic. By the author.

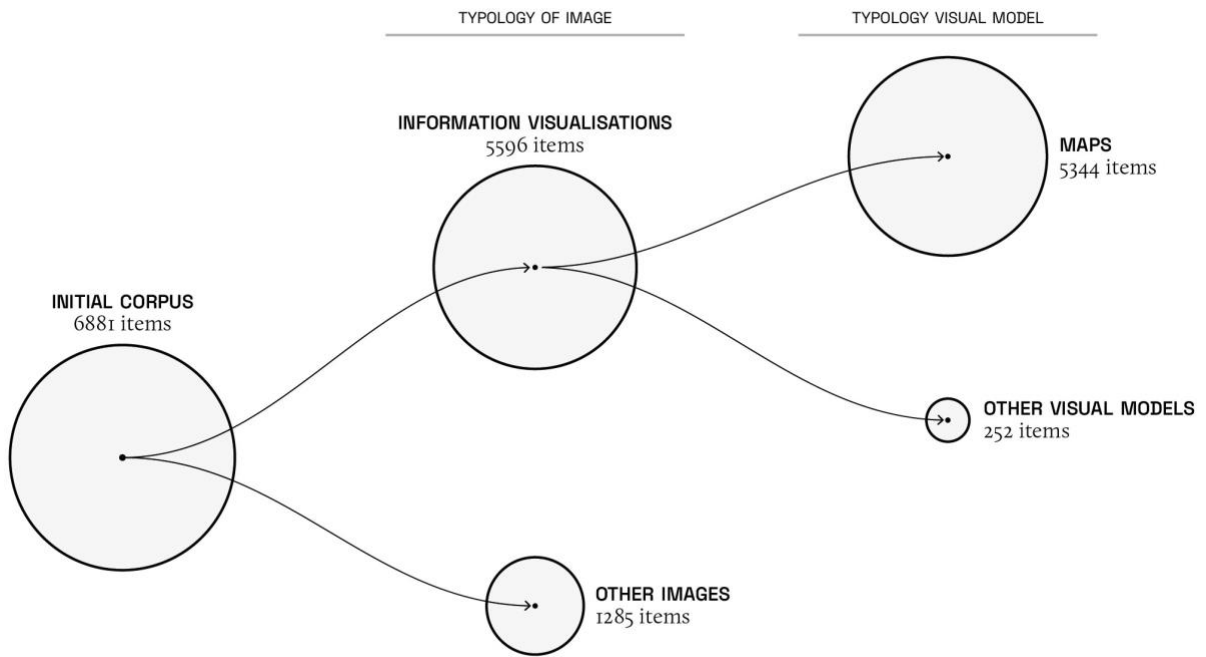


Figure 6. Linear dendrogram showing the classification of the corpus of images collected on Twitter during the first week of the Russo-Ukrainian conflict. By the author.

The interesting preliminary finding so far regards the frequency of “repeated images” in the collection: those images published across different accounts with varying accompanying texts (see Figure 7). This introduces the concept of “circulationism” (Steyerl, 2013) since the meanings of these visualisations can evolve through the fluid and collaborative nature of online practices (i.e. copying, tagging, commenting, sharing, downloading, re-uploading, and modifying). Furthermore, both analyses indicated that each social crisis is associated with a preferred visual model, such as time-series for Covid and maps for the conflict.

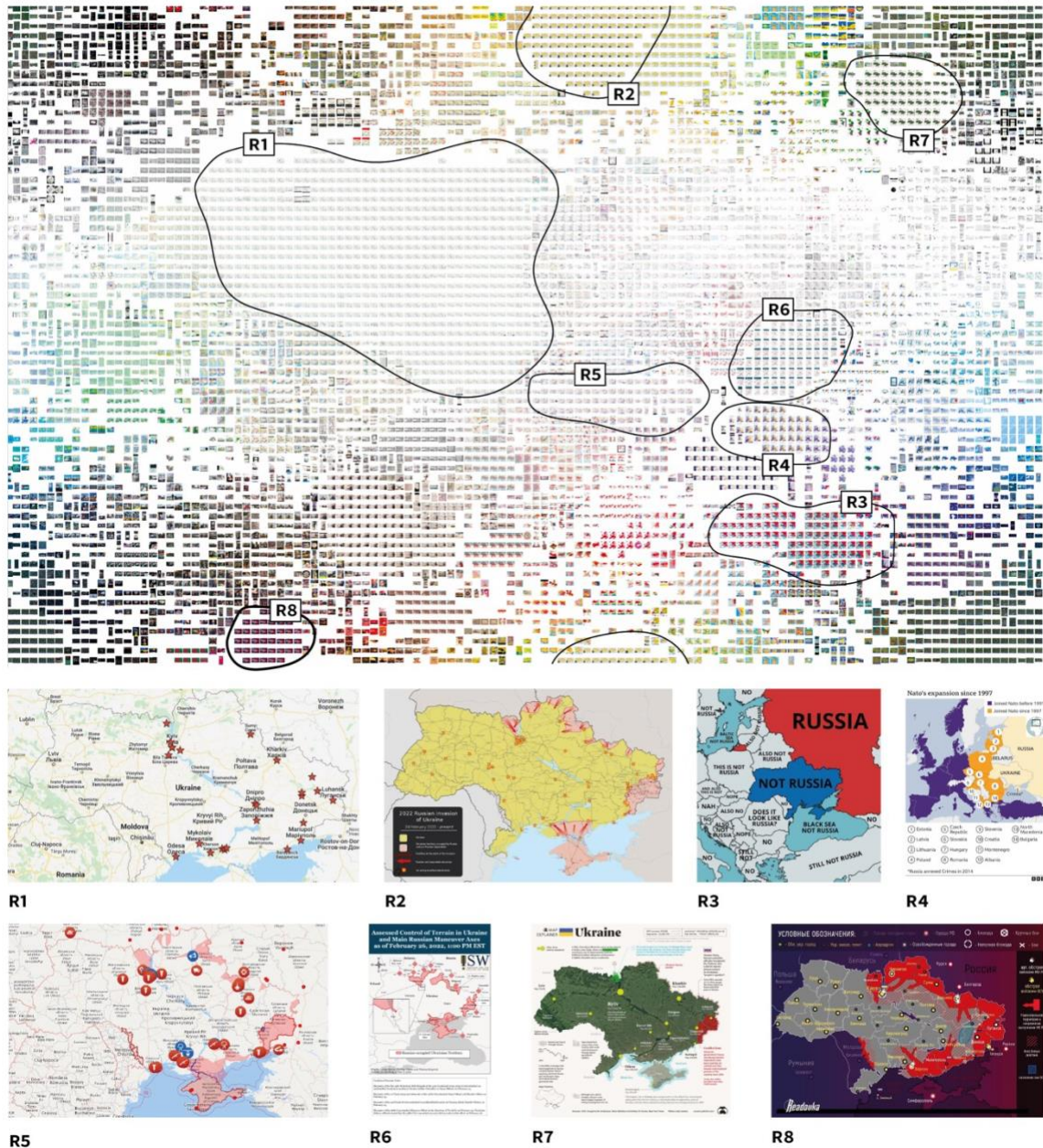


Figure 7. Overview of some clusters of “repeated images” in the collection. By the author.

## 4 Discussion

The research is now delving into phase two, which is crucial for developing the field guide. Validation and evaluation activities will be carried out during the last stage of the project's process, along with all the activities conceived to define how to adopt the field guide within Media and Information Literacy contexts. Hence, the research explores misleading information visualisation and uses the approach of information visualisation to design viable resources for contextualising and addressing the issue.

The research will provide a kind of knowledge contribution which will be convenient for i) the information design field as a tool that systematises prior knowledge, ii) the fields touched by the different Media and Information Literacy initiatives as a robust resource for supporting literacy on the topic of misleading information visualisation circulating on social media platforms as informative devices during societal crises.

To conclude, the relevance of research in the European context is also supported by calls funded to mitigate the problem (e.g. The European Media and Information Fund<sup>3</sup>).

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<sup>3</sup> The European Media and Information Fund (EMIF) opened three calls for proposals for projects that focus on fighting disinformation in Europe. One of the three calls regards “Media and Information Literacy for Societal Resilience” and supports “initiatives that empower citizens by strengthening their ability to think critically, assess the trustworthiness of information accessed or shared through social media, fully understand the mechanisms that shape online interactions amongst social media users, and take part in the public discourse in a responsible and meaningful way.” (EMIF, 2023)

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