Visualizing national and international deaths with data during the COVID-19 pandemic

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Abstract

This study focuses on the difference between visual representations of data concerning international and domestic COVID-19-related deaths in a selection of European countries. Both semi-quantitative and qualitative analyses are carried out on a sample of 255 data visualizations published in the digital editions of selected European newspapers. The visualizations were originally included in 97 news articles published by media outlets online, across ten European countries between February 2020 and April 2022. Data visualizations are analyzed using visual and textual framing methods, and results show that COVID-19-related visualizations follow different stylistic and framing patterns if the data represented concern domestic or international victims. This finding is in line with how journalists traditionally cover crises, such as wars. Additionally, the importance of death can be subtly diminished with techniques of statisticulation. Despite the global implications and consequences of the pandemic and journalists' efforts to report beyond their own national boundaries, the enforcement of domestic interests seems to have been a priority.

Introduction

During the COVID-19 pandemic, statistics have dominated the news coverage of data-driven journalism. The daily coverage of infection rates, the number of victims, and other numbers related to the pandemic have been so common that a shared visual language related to COVID-19 has emerged (Alexander & Smith, 2020). This language came about through the reiteration of familiar generic visuals: computer-generated or illustrated representations of the virus molecule, stock photos of doctors and syringes, or simple statistical charts like the flatten-the-curve line chart, choropleth maps, bar charts, and line charts (Aiello et al., 2022). Furthermore, at the top of the online and printed editions of international and domestic newspapers, interactive dashboards or tickers appeared, showing distinct kinds of numbers and charts monitoring the pandemic's development (Comba, 2020). While the statistical dashboards about the pandemic shared generic visual representations of statistics, the way in which journalists covered data in individual articles both in text and with visualizations differed across the globe (see, for example, Quandt and Wahl-Jørgensen, 2021). This is not surprising: different contextual settings are related to different journalistic cultures, and national borders are one of the many variables at play in distinguishing between them (Hanitzsch et al., 2019). Moreover, in increasingly data-rich societies, data is journalism (Shirky, 2014, as cited in Nguyen, 2018), and this specific kind of journalism – namely data journalism – might differ across journalistic cultures.

In the case of the COVID-19 pandemic, data journalists vowed to explain to their audiences how the crisis unfolded through the use of official and publicly available data while maintaining their journalistic autonomy and authority (Cairo, 2019; Quandt and Wahl-Jørgensen, 2021). To do so, data journalists communicated scientific data about COVID-19 to general audiences, relying on the ability of their readers to be "risk-literate", i.e. make sense of visual depictions of risks and translate these images into informed and ethical decision-making (Amidon et al., 2020). One of the key datasets used for this goal traced the number of deaths caused by COVID-19 (Romano et al., 2020). To communicate these data, journalists often resorted to data visualization – graphical representations of abstract data (Gershon et al., 1998). Previous research has shown that data visualization plays a key role for journalistic storytelling, and design elements have a strong impact on readers' perceptions and emotions (Hullman & Diakopoulos, 2011; Morini, 2024). Data visualization is a promising method, as readers are more likely to make sense of graphical representation of numbers and retain their key message for longer periods of time, especially compared to other visual

artifacts, like illustrations (Garretón et al., 2023a). However, previous research has also found that data tend to be reported as neutral, impartial, and objective when data visualizations are used in journalistic contexts (Garretón et al., 2023b). In relation to death, this tendency can be especially problematic.

Already at the very beginning of the pandemic, in March 2020, when the virus had caused around 20,000 victims and 500,000 more people were known to be infected, the director of the World Health Organization, General Tedros Adhanom Ghebreyesus, stated "we are at war", describing the virus as deadly and framing the pandemic as the defining moment of our time (Chappel, 2020). Previous research has paid attention to how domestic media coverages support their own government efforts in times of war, with a clear division between "national" and "international" causalities (Craig, 2009; Hanusch, 2010). Furthermore, domestic deaths enjoy a preferential visual treatment compared to international ones – with the use of dedicated photographs (Hanusch 2010). Also, in relation to COVID-19, media have frequently used textual metaphors to create a sense of national belonging and to support governmental measures (Aiello et al., 2022; Varma, 2020; Wodak, 2021).

Research on the representation of death in data visualizations is scarce, particularly when it comes to COVID-19-related deaths. Visualization has become globally known as a method for journalistic inquiry, yet because the expertise and guidelines available to journalists differ between countries and the COVID-19 crisis unfolded differently around the globe, the charts produced by data journalists differ. For this reason, a study that looks at how design elements are used in pandemic-related visualizations could show how graphic design and statistical methods are used in contemporary data journalism.

In this study, we chose to specifically focus on the differences between how international and domestic COVID-19-related casualties are represented across a selection of European countries. The study uses qualitative content analysis with quantitative elements to analyze 255 European data visualizations of COVID-19-related deaths. These visualizations belong to a sample of 97 online articles. The collected stories come from 33 media outlets in ten European countries (see Appendix 1 and the 'Method and sampling' section). Five of the selected countries (UK, Czechia, Italy, Spain, Portugal, Germany, and Sweden) suffered high numbers of casualties (January 2021); the other three (Norway, Denmark, and Ireland) had relatively fewer reported cases and deaths. Based on these premises, the methods of content analysis and verbal/visual framing are used to answer the following research questions:

RQ1. What differences can be observed between representations of domestic and international COVID-19-related deaths?

RQ2. How can design elements in data visualizations be used to emphasize COVID-19 related death?

The next sections include a succinct literature review, which serves as context for our work. The sections are organized in three main research directions: the role of visualizations and design in making news-worthy charts; the definition of statisticulation and the risks it might pose; and finally, how war metaphors are used to present deaths related to COVID-19.

Visualizations and designs during the pandemic

Cairo (2019) has recognized the role of COVID-19 very early in determining the mainstream popularization of data visualization, given its key role in representing the development of the pandemic. Visualizations of COVID-19 were created across domains to convey many different messages to a variety of audiences.

Zhang et al. (2021) looked at 1,184 public-facing pandemic visualizations from English-speaking news outlets and government websites and found the following main communication purposes: to inform about COVID-19 severity; to make predictions and explanations about the nature of the crisis; to offer advice on how to reduce risk; to communicate risk, vulnerability, or equity; and to measure the crisis's many effects. Most visualizations focused on the current state of the crisis, making historical comparisons in the early stages of the pandemic before shifting to the trajectory of the crisis over time and the geospatial spread (ibid.). Some of these visualizations have become iconic. For instance, the most common visual based on predictive data became known as 'flatten-the-curve', a bell-shaped curve of how COVID-19 should, after reaching its peak, flatten out again (Pentzold et al., 2021). Among these, there were also guides explaining social distancing practices, the nature of the disease, risk factors associated with the disease, and its economic impact on society, and as the crisis grew, visualizations were updated and their visual style changed (Zhang et al., 2021). Stylistic choices about colors and other design elements can affect how users see risk (ibid.). Also, the differences and similarities in how visualizations are designed across media outlets may show biases, power issues, and media positioning that are inherent in widely used visualizations (ibid.).

In a study of how audiences react to visualizations of COVID-19, articles with interactive visualizations were found to be more frightening than articles without visualizations (Oh and Hwang, 2021).

However, these findings are not definitive. Markant et al. (2023) have also found evidence of little attitude shift related to visualizations – especially in the presence of high uncertainty. The topic of COVID-19 in visualizations appears to support mild attitude changes at best, with readers maintaining previous beliefs despite being exposed to data. This is significant since the COVID-19 coverage was characterized by uncertainty from the beginning; in some cases, the data were only temporary estimates (Cairo. 2019). Moreover, COVID-19 visualizations were often banal (Aiello et al., 2022), reproducing empty versions of nationalism in the face of the crisis. (ibid.). This stands in contradiction to what has been argued by Hanusch (2010): journalistic images of death have the ability to project reality and are viewed as powerful documentary evidence. However, specific to the COVID-19 visualizations proposed by news outlets was that they were often repetitive and largely symbolic (Aiello et al., 2022; Delicado and Rowland, 2021).

Ultimately, the role of visualizations in COVID-19 still seems uncertain. On the one hand, news outlets largely popularized data visualization as a method to support audience sense-making during the pandemic. On the other hand, it is still unclear what impact these visualizations had on readers. Researchers have been skeptical about their ability to inform beyond pre-formed beliefs. It also remains underexplored how visualizations' design might have played a role in the shaping of journalists' rhetorical arguments.

Statisticulation in data visualizations

Data journalists tend to use simple statistical charts such as bar charts, line charts, or area charts as they afford low visual complexity (Zamith, 2019). Such charts are used to represent data related to a specific issue. Journalists carefully design them to be easy to understand, appealing, and ideally mathematically correct.

This process of simplification is prone either to casual or intended statisticulation (i.e., the act of misinforming someone using statistical material) (Huff, 1954). Statisticulation happens through the exaggeration, oversimplification, or distortion-through-selection of data. For instance, one can use scale in various misleading ways to either highlight or downplay important aspects in the data (Kask, 2007). Scale manipulations include cropping baseline values, omitting the graphic representation of the scale, or editing out the middle values in a chart. These practices are context-dependent and not

intrinsically wrong but can make it difficult for readers to understand the data.

In relation to scale, Romano et al. (2020) have looked at COVID-19 visualizations, with a specific focus on death. By testing readers' ability to understand visualizations with logarithmic and linear scales, they found that readers generally favor linearity since the data then will appear straightforward. However, readers also perceived COVID-19 as more catastrophic than usual if presented with linear scales rather than logarithmic. Similarly, changing the aspect ratio of the graphic elements within a chart can lead readers to under- or overestimate change (Fan et al., 2022). Plotting multiple variables on a single chart may encourage readers to compare unrelated data (Kask, 2007). Using certain colors (e.g., red) can cause elements to appear bigger than they actually are (Fan et al., 2022). According to Doan (2020, p.75) and Cairo (2015), even when charts are accurately designed, they can still grossly mislead readers by displaying deceptive patterns or by providing inadequate or incorrect information. Doan (2020) studied examples of misleading COVID-19 visualizations and found that some of these were using pie charts to show infection rates, comparing two unrelated charts, cropping scales, and making the Y-axes range unclear. Moreover, Alieva (2021) found that despite its claims of objectivity, news coverage enhanced by data and statistics still suffers from framing effects, influencing readers' interpretation of key events. The author observed that while objectivity and transparency constitute the basis of data representation, rhetorical strategies are used to co-opt these values into forming connoted interpretations of news events. In this context, it is meaningful to note that data journalists do not have specific codes of conduct related to data visualization but make use of their subjective understanding – informed by key journalistic values like transparency, truth, objectivity, privacy, and diversity – to ensure data and visualization quality (Morni et al., 2023). These previous contributions provide consistent evidence of how data visualizations can be manipulated for rhetorical intents. These findings also suggest the tendency of data journalists towards simplification and the lack of consistent guidelines on how to design visualizations for journalistic coverage.

The COVID-19 pandemic as war and visual enemy

In the case of death, previous research has found that its visual display for news coverage varies across countries and cultures.

Hanusch (2010) offers several factors of influence, such as religion, previous domestic experiences with war, as well as political

and economic reasons. In general, newspapers tend to show little imagery of victims. When it happens, it is more common for newspapers to show international deaths rather than national ones (Hanusch, 2010). Moeller (2002) suggests that international events are treated in a more sensational or dramatic manner to catch national audiences' attention. This happens especially if an international crisis seems remote and death poses no direct risk, or if crises are uncertain and casualties are difficult to attribute. Regarding domestic death, certain countries might impose governmental restrictions or censorship to limit its display. During war, media ownership and journalists themselves tend to practice self-censorship to not upset their audiences (Hanusch, 2010). In global disasters, journalists have been found to initially fixate on reporting the latest body count, then moving on to human interest stories about "our" nationals involved, to then favor national infused coverage where examples of international solidarity are presented, for instance the sending of help to the distant crisis (Cottle, 2009). Moeller (2002) has argued that journalists might also tend to escalate their language during conflicts. They might be affected by "compassion fatigue", i.e.: progressive use of language and images that make the event look deadlier in comparison with previous events. Reasons behind this behavior are linked to journalists belief that audience's attention is limited, and that readers might become bored without an escalating effect.

During the early stages of the COVID-19 pandemic, Krawczyk et al. (2021) found that 16% of COVID-19 news articles from eleven countries were highly negatively polarized, citing issues such as death, fear, or crisis. Baekkeskov, Rubin, and Öberg (2021) analyzed Danish and Swedish media coverage in the initial stages of the COVID-19 pandemic with a focus on the justification of the policies their government had chosen, with the measures being repeated without any encouragement for open public debate. Varma (2020) showed that the war metaphor not only unites people against the virus, but also that the use of medical militarism motivated individuals positively and produced an attitude to fight the "war", with medicine as a war tactic. Wodak (2021) analysed crisis communication about COVID-19 in Austria, Germany, France, Hungary, and Sweden. She found four distinct frames used by political leaders to mitigate the audiences' dread: a "religious frame", a "dialogic frame", a frame emphasizing "trust", and a frame of "leading a war". Indeed, political leaders in these European countries used the war frame repeatedly to suggest an upcoming domestic victory against the virus. They called for national unity around government measures. For instance, Panzeri et al. (2021) have focused on Italy, reporting similar findings and showing how a bellicose framing of

COVID-19 could have supported negative emotional responses. In a study of how COVID-19 deaths were covered in New Zealand, Morgan et al. (2021) found that COVID-19 was framed as a 'battle' where victims were turned into conflict's casualties. Since these victims were often the elderly and vulnerable, researchers found that journalists played an advocacy role in justifying the country's lockdown measures with compassionate coverage of older people's deaths, praising the national COVID-19 strategy and restrictions. Likewise, in a study on British coverage, Sowden et al. (2021) found stories where journalists created a 'war-like' conflict between people complying with social distancing regulations and those who were not, creating a battle against "lockdown rebels". Furthermore, in public statements by world leaders, the COVID-19 pandemic was likened to a war with the virus as the invisible enemy; terminology included war-like terms such as "curfew" or "frontline workers" (Varma 2020). In daily press conferences, medical experts were framed as war heroes, given their centrality in updating citizens about the spread of the disease and the measures taken on a state level to stop or curb it (Craig, 2020). Whereas the war metaphor was popular at the beginning of the pandemic, as time progressed, new local metaphors emerged – showing specific features of the crisis (Hanne, 2022). Nevertheless, war analogies and the use of bio-militarism in journalism are not a new phenomenon and have been observed in covering other epidemics such as, the Spanish flu, cholera epidemics, or AIDS (See for example Craig, 2020; Spratt, 2001).

This corpus of research shows how the war metaphor has infiltrated the journalistic discourse about COVID-19. However, research falls short in showing if and how data visualizations with their distinctive graphic elements might have been influenced by these rhetorical strategies.

Method and sampling

This study isolates and analyzes the graphic elements belonging to a sample of 255 data-journalistic visualizations on COVID-19-related deaths. The aim of this analysis is to understand what visual strategies are used by journalists when representing death through statistical charts by answering RQ1 and RQ2. 97 news articles from online news media outlets in ten European countries featured the visualizations in our sample. The countries were Italy, Germany, Spain, the United Kingdom, Portugal, Ireland, Sweden, Denmark, Norway, and Czechia. Despite being geographically and economically close, these countries reacted to the pandemic with very

different measures, making them a compelling example of the pan-European coverage of COVID-19.

The timeframe of the collection went from February 2020 to April 2022. The timeframe was chosen to obtain a diverse range of articles reflecting the different phases of the pandemic as it unfolded. The selection of media outlets in each country was primarily based on their market data from the Reuters Institute 2021 Digital News Report (Newman et al., 2021); we selected media outlets listed in the top ten for weekly reach in each country. We strived to include at least one public service company, one major morning newspaper, and one major tabloid newspaper in our sample. After an initial data sampling activity, we realized that many of the major news outlets across our sample of countries did not publish visualizations that met our criteria. Oftentimes, these outlets relied on generic dashboards at the top of their webpages instead of producing original coverage. For some countries, we had to exclude certain news outlets in favor of others. Some of these cannot be considered major but still produce authoritative and reliable coverage.

The final list of outlets range between 2 and 5 different ones per country. For **Sweden** we included: *SVT*, *Aftonbladet*, *Dagens Nyheter* and *Svenska Dagbladet*; **Denmark**: *DR*, *TV2* and *Jyllandsposten*; **Norway**: *VG* and *Aftenposten*; The **Czech Republic**: *TV Nova News* and *Denik*; The **UK**: *BBC*, *The Guardian*, *Sky News* and *Daily Mail*; **Portugal**: *Cm*, *JN*, *Noticias au Minuto* and *Sapo*; **Ireland**: *RTÉ*, *BreakingNews.ie*, *Irish Mirror* and *The Business Post*; **Italy**: *Il Sole 24 Ore*, *Il Corriere della Sera*, and *L'Avvenire*; **Spain**: *RTVE*, *el Pais* and *el Mundo*; **Germany**: *Der Spiegel*, *ZDFheute*, *die Zeit*, and *Süddeutsche Zeitung*

We included only data visualizations, defined as graphical representations of numerical data (Gershon et al., 1998). We did not include comics, illustrations, or photographs – unless combined with a chart and matched with a unique caption.

Many studies based on content analysis of journalistic content are focused on the framing of issues found in both textual and visual content (Wahl-Jorgensen & Hanitszch, 2009). For this study, we chose to focus on online articles that included visualizations, since the online news format, to a greater extent than, for example, the mobile news format, has the potential to include rich interactive content. During the pandemic, most online news outlets published statistics in a general dashboard found on top of the page or at times embedded in articles. Dashboards contained, for example, number of people infected, deceased, vaccinated, recovering or in intensive care or recovering from intensive care on a national or regional level. The dashboards were updated daily and often embedded repeatedly in news articles about COVID-19. Given their lack of direct

relationship with individual articles, we chose to exclude such dashboards and focused on articles with unique visualizations featuring death by COVID-19. Furthermore, we opted to eliminate duplicates of visualizations. Choosing this delimitation resulted in a very focused sample where only original visualizations were included, avoiding those that were repeated over time. Thus, we did not focus on representativity for all articles published on death by COVID-19 but strived to find a comparative sample of unique visual strategies for visualizations on death by COVID-19, tailored and designed to fit a specific news angle of that article. In articles with several visualizations, every instance with its unique caption was considered a unit for analysis. Since there is no comprehensive sampling frame for data journalism projects (Lowrey & Hou, 2021), we constructed a non-probabilistic sample. Previous research has often focused on award-winning data stories (see Loosen 2020; Ojo & Heravi, 2018). In our case, we decided to scrutinize "everyday" data journalism, which has the potential to better represent the overall discourse about pandemic-related deaths. Contrary to Zamith's (2019) study on North American "everyday" data journalism, we did not access content programmatically (i.e through the Twitter API). The reason for this is that in a European context, few news organizations have separate graphics teams dedicated to data journalism, as well as open archives and accessible APIs. Hence, we approached the research by mirroring the behavior of a regular online audience member if they were looking for data journalism visuals focused on the pandemic.

We employed a systematic approach to identify articles, mirroring the public's online search behavior. Initially, we scrutinized the main landing page of the media outlet, clicking on every mention of 'Corona' or 'COVID-19'. Then, we performed a more granular exploration by searching for 'COVID-19' or 'Corona' and the word 'death' in each language using the search function on the news websites. If no search function was available, or it did not include more than the most recent published articles, we used the COVID-19 or Corona tags provided by the outlet at hand or searched for articles created by data journalists at the news outlet. When available, we considered the special sections dedicated to 'data' or 'data journalism' as containers for data visualization projects. In this case, we only selected the projects related to COVID-19. The approach was reproduced systematically across all publications.

In this non-probability sample, death had to be mentioned in the headline, lead, or body of the news story and be the focus of the visualization. The number of articles that met our criteria turned out to be low. Our research design partially explains this. We made the decision to exclude duplicate articles featuring a visualization that

appeared repeatedly. Since we collected articles in retrospect, it was also difficult to track pieces that had been updated or removed. We found that while some media outlets published several ambitious data-rich projects monthly, others repeated the same graphs over time.

Appendix 1 contains the total number of articles and visualizations, broken down by country and media company. Some countries had an abundance of visualizations, while other countries and media outlets published few visualizations depicting COVID-19-related deaths. To balance our selection, we considered ten unique articles per country, except for Portugal and Ireland, where we were only able to gather eight.

Coding instrument

Given the hybrid nature of data visualizations (Uggla, 2021) – combining text and visual elements – we included both quantitative and qualitative elements in the content analysis and coded for both verbal and visual frames. Frames have been widely studied to influence the formation and accessibility of beliefs, attitudes, behavioral action, and policy support regarding an issue by defining problems or issues, identifying who is responsible for an outcome or at the center of an issue, involving moral judgments, and suggesting remedies (Entman, 2004; Tewksbury & Riles, 2018).

A frame repeatedly invokes the same objects and traits, using identical or synonymous words and symbols in a series of similar communications that are concentrated in time (Entman, Matthes & Pellicano, 2009, p. 177). Following Dan (2018), we created two distinct datasets. In the content analysis for frames, each article has been treated as one unit of analysis for variables concerning text. This dataset contains the article with the title and number of visualizations, marked by a unique identifier. Since articles usually contained several visualizations, in the second dataset each visualization is treated as a sub-unit. Here, unique features of the visualizations – for example, chart type, interactivity, etc.—were coded. Both data sets were joined together by the unique identifier, matching the article with its visualizations.

To identify verbal frames, our approach was to build on recent framing death-related scientific research in health, war, and risk crises covered by the media. Therefore, we looked at headlines and used Krishnatray and Gadekar's four frames of constructing death in the H1N1 death news coverage (2013). We did so to find clear examples of death-related discourse. Krishnatray and Dadekar's frames consists of the fear-panic frame; the attribution-of-responsibility frame; the action frame; and the human-interest frame.

Moreover, since numbers are central to data journalism projects, we added frames associated with numbers (Lee et al., 2019), such as the safety-assertion frame; and statistics frames such as variable, trend, value, and balance as suggested by Kong et al. (2018).

Frames were not considered mutually exclusive; one headline could hold multiple frames. We coded headlines as the fear-panic frame if the headline contained wording that implied COVID-19 as extremely dangerous and catastrophic. The attribution-responsibility frame was for headlines that implied responsibility for death. The action frame encompassed headlines that detailed institutional measures or actions taken to prevent deaths. We used the human-interest frame for headlines that showcased emotions, or a personal or human element associated with death. For the safety-assertion frame, the headline had to include statements as to whether a given death statistic indicated that conditions were safe or unsafe. For the statistics-variable frame, the headline compared numbers; for the statistical-trend frame, the heading mentioned a trend; and for the statistical-value frame, the headline simply included a number. For the statistics-balance frame, the headline presented both sides of an argument. We also coded frames called "Other" for headlines that did not fit into any of the frames described above.

To be able to discuss the representation of death in visualizations, we used Cairo's categorization of graphs (2019) and Weber's framework for analyzing interactive visualizations (2020). We analyzed the charts in Cairo's (2019) extensive taxonomy, dividing them according to type of chart or table, representation of scale, and timeframe. We considered these variables as key in detecting visual patterns in how death is represented: as already mentioned above, the choice of chart or scale can influence readers' understanding and foster certain emotional and even rational responses to the topic. Moreover, these variables are also highly dependent on each other. For instance, the representation of scale is dependent on the type of chart. We considered the position of the maximum data point in relation to its axis as fundamental in changing readers' perspectives on data, as also suggested by Sinar (201, p. 143). We coded for how the maximum data point was positioned on the scale in relation to the last axis tick, for example, if it was over, under, or matching. We coded for the possibility for the reader to interact, for example through scrolling, filtering, or clicks (Appelgren 2018; Engebretsen et al., 2018; Stalph 2018).

Three researchers independently coded the articles. To test the reliability, we coded percentage agreement between all three coders. We chose to calculate percentage agreement since most of our variables were binary and most of them was not equally probable, ie. they tended to be 1 with much higher frequency than 0. The first

test resulted in too low reliability. We revisited the code book and did a recode of the entire sample. Then, a second percentage agreement test for all 33 variables was conducted. It resulted in a range of percentage agreement for the variables between 0,67 and 1. The majority of the variables had a score above 0,93. We decided not to use two of our variables which had considerably lower agreement (0,53). These variables were completely excluded from the analysis.

Results

Pandemics are global phenomena. Hence, journalism about pandemics contains both national and global perspectives. Within our sample, around half (48%) of the visualizations had an international focus.

Articles about COVID-19 were usually published under dedicated COVID-19 subsections of the news websites. More specifically, numbers and statistics about COVID-19-related deaths were found in four distinct types of items: 1) as part of dashboards, at the top, bottom, or at the margin of the main homepage of websites; 2) as general and updated visualizations, embedded within every COVID-19-related article either at the bottom or inside the article and regularly updated; 3) on separate summary pages with several different visualizations about the pandemic; and 4) in articles, where visualizations were tailored uniquely depending on the topic.

The sample of articles held at least one, but mostly more than one, visualization per article (mean 5.56, std. deviation 4.783), ranging from 1 (found in 9% of the articles) to 40 (found in two articles). Not all the visualizations included in an article were about COVID-19-related deaths. The mean for 'COVID-19-related deaths visualizations' per article was 2.68, standard deviation 4.025.

Across the sample, line charts, bar charts, heat, and choropleth maps were the leading chart types across our sample. In Denmark, Norway, and the Czech Republic, we also observed a high use of interactive features to help readers focus on certain aspects of data, particularly the comparisons across countries. The data used to create these charts also varied based on country and subject. Figure 1 shows how the visualizations about death were created from various datasets and based on a variety of metrics, with the most common one being the total number of COVID-19-related deaths followed by others, meaning that one visualization could contain several types of measures, including "deaths from other causes". We found that data about COVID-19-related deaths were often depicted in relation to other kinds of data about the pandemic (infected, vaccinated,

recovering from intensive care, etc.) or other unrelated causes of death (i.e. traffic deaths).
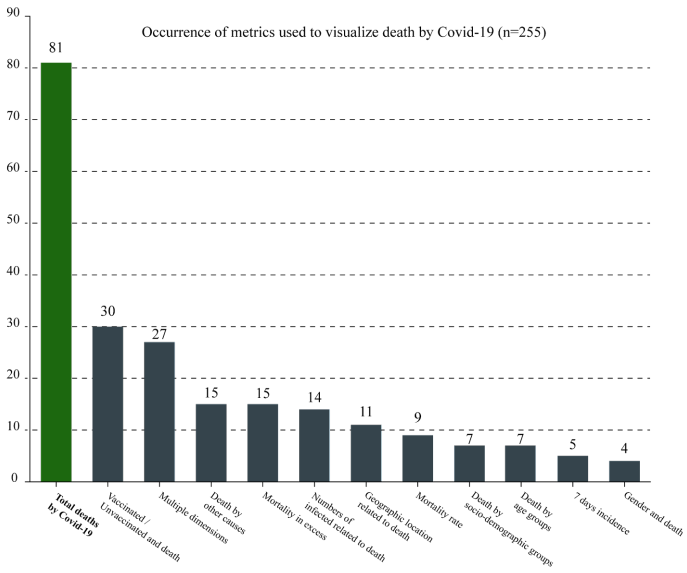

Figure 1: Metrics used to visualize COVID-19-related deaths (n=255).

The selected metrics included in charts were different when the visualization illustrated international or domestic fatalities ($X2(11, 225) = 33.988$, $p = 0.001$). While the most common metric for both international and domestic deaths was total number of deaths, the second most common for domestic death-focused articles were "death by other causes" (24 charts with domestic deaths compared to 3 charts with international deaths).

Domestic deaths were often grouped according to socio-demographic groups (7 domestic vs. 0 international charts). Instead, international casualties were shown in relation to other metrics (12 domestic vs. 18 international), for instance, the number of people deceased against the total number of infections (5 domestic vs. 10 international).
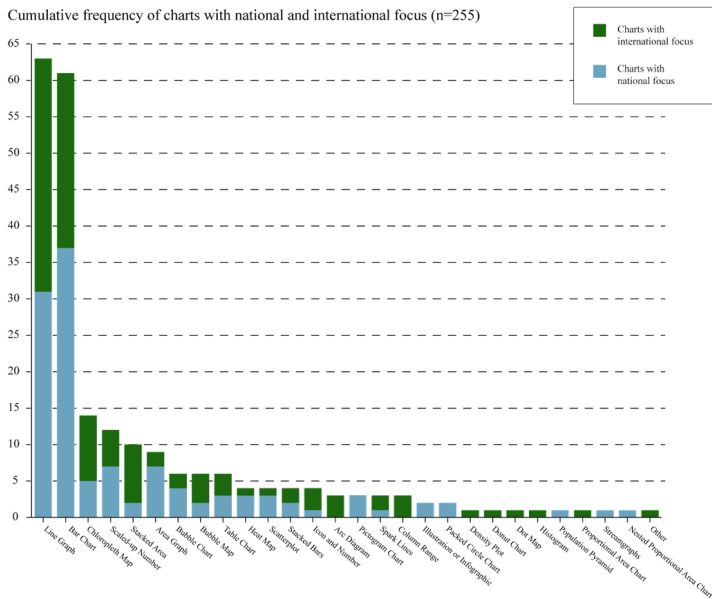
Cumulative frequency of charts with national and international focus (n=255)

Figure 2: Type of visualization in relation to international or domestic focus (n=255).

Verbal frames in articles with visualizations of COVID-19-related deaths

We analyzed headlines within our sample and appreciated the complexity and multi-layered nature of how news angles are represented as frames. For instance, headlines typically included several frames used for the analysis. In total, the most common frame used for headlines was the safety-assertion frame (1), followed by the variable frame (2), the fear-panic frame (3), the trend frame (4) and lastly by the category "Other" (5). This category turned out to be one of the largest in our sample and was surprisingly uniform. Headlines coded as 'Other' all pointed to summaries of data collections with the aim of guiding the reader; for example "Here is the latest data on COVID-19" or "This is the pandemic in numbers."

When analyzing frames used for international news angles about death by COVID-19 compared to content about national death, we found some significant differences (see Table 1). It was more common to find the fear-panic, safety-assertion and human-interest frames for visualizations of domestic deaths, while for depicting international ones the frame "Other" was preferred, meaning that journalists tended to refer back to current statistics, dashboards, and in general informational guides to data with titles like "Here you can find the latest numbers".

	International deaths	National deaths	Chi2 p-value
Attribution of responsibility	15	10	0.186
Action	10	5	0.125
Human interest	1	14	<.001
Safety assertion	40	73	<.001
Variable	39	60	0.032
Trend	22	40	0.025
Value	13	19	0.397
Balance	8	5	0.298
Other	41	18	<.001
Total	**107**	**118**	**255**

Table 1: International or national COVID-19-related deaths depicted in visualizations in relation to the news frame in the headline of the article (n=255).

Visual frames in articles with visualizations of COVID-19-related deaths

We found 28 different types of visualizations, and the most common were line graphs (28%), bar charts (27%), choropleth maps (6%), scaled-up numbers (5%), and area graphs (4%) (see Figure 2). When an X and Y axis were included, we noticed that data points were sometimes positioned beyond, above or below the last tick on the scale. Thus, in visualizations where a scale was included, for instance, in a line chart, the highest record of fatalities was sometimes pictured above the maximum provided on the given scale and sometimes under the highest point on the scale. There were also instances where the maximum number of fatalities perfectly matched the last tick on the scale (see Table 2).

	%	CZ	DK	DE	IRL	I	N	S	ES	P	GB
Under the scale	40%	15	3	4	4	5	5	10	8	4	7
Over the scale	39%	2	7	16	2	0	7	6	4	3	5
Matches the scale	12%	0	2	3	1	4	0	1	2	2	1

Table 2: The maximum data point in relation to the scale and across countries.

Our results indicate that the position of the maximum data point differed significantly across countries for those charts that included a scale ($X2(18, 133) = 40.825$, $p = 0.002$). In Denmark, Germany, and

Norway, it was more common for the maximum number of deaths to be visualized over the maximum graphical benchmark provided by the scale. In Czechia, Sweden, Spain, and the UK, it was more common for the maximum number of deaths to be visualized under the scale's maximum point. Interestingly, in the latter case, these countries can also be found among those that in January 2021 had suffered more deaths than the other countries in the sample. Furthermore, when taking into consideration whether the story focused on international or domestic deaths, for the countries where it was more common to represent the maximum number of deaths over the maximum tick of the scale – Denmark, Germany, Norway, and Portugal – the charts were mostly visualizing COVID-19-related deaths abroad.

Discussion

Visualizations appearing in news media are designed to convey certain messages. However, graphs and interactive visualizations in journalism, like photographic images, rarely stand on their own. Hanusch (2010) asserts that this is why images are powerful; they are woven into narratives and used to enhance the truthfulness of the text. In our sample, data visualizations about death were interwoven with other textual and visual elements, describing and depicting various other aspects connected to the pandemic. Similarly, to what was suggested by Aiello et al. (2022), the individual visual components about COVID-19 in our sample were generic and often reiterated. Aside from confirming the use of generic visuals and repetitive schemas, our focus on the different treatment of international and national deaths shows a noticeable pattern. National deaths were often framed together with deaths from other causes, for instance, car accidents (24 domestic vs. 3 international). The combination of metrics could be an attempt to minimize the impact of the pandemic in the reader's own country. International fatalities were put into perspective with other metrics (such as recoveries, infections, etc.), sometimes data were shown for multiple countries at once.

This higher variation of metrics and deluge of data could be an attempt at avoiding "compassion fatigue", where journalists try to make an event more interesting in comparison with previous events. This is achieved, for example, by emphasizing a crisis as more deadly than a previous similar crisis (Mueller 2002). Aiello et al. (2022) have already observed this tendency to compare countries' fatalities and described the practice as taking the form of "a (very deadly) global sporting event, in which nations were presented in a competition with each other on who did a better job in

managing the global pandemic" (p. 326). This too signals support for national efforts and an attempt to minimize the impact on the reader's own country.

Our findings also reflect how journalism about the pandemic uses the same war metaphors used by politicians and leaders, as also highlighted by previous research. We found subtle signals justifying government restrictions and a tendency to describe the pandemic as how war traditionally is covered: a focus on body count, country comparisons where one's own nation comes out as a winner, and how international death seems to be treated differently compared to national death.

Because saliency, such as the use of color and size, was not part of our analysis, Figure 3 is included here only to illustrate what saliency can look like in news visualizations with, for example, the strong color black representing death by COVID-19. We suggest that saliency in visualization would serve as a compelling case for future research.
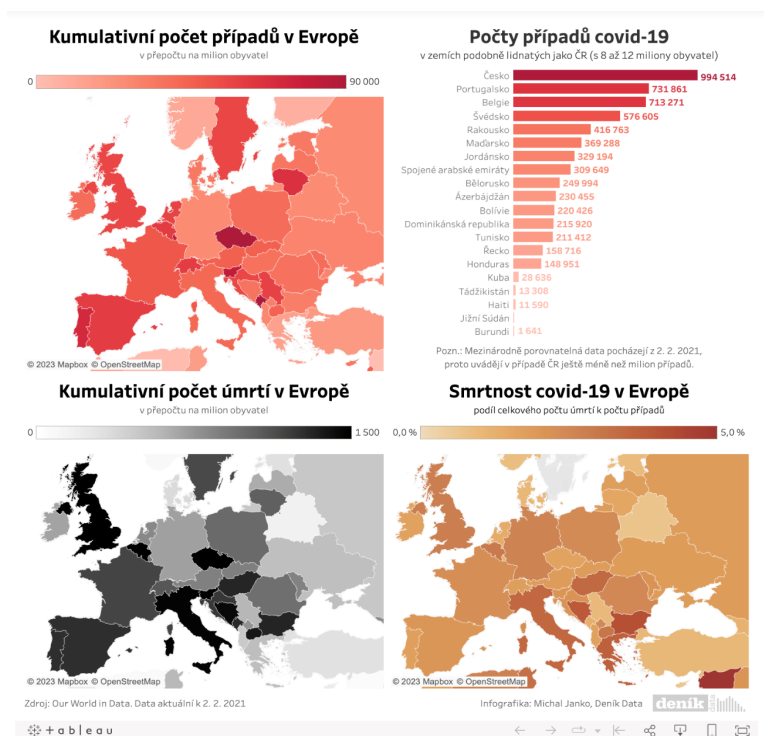

Figure 3: An example of use of saliency (Janko, 2021). Translated to English, the four captions display: "Accumulated number of cases; Number of COVID-19 cases; Accumulated number of deaths in Europe; Rate of death by Covid-19 in Europe".

The analysis on frames shows how articles that discuss domestic deaths are prone to include headings hinting to fear and giving more importance to individuals and their safety. We found examples of subtle warnings in headlines that could induce fear yet coupled with comforting safety assertions. For example, in an article on excess mortality from the Danish public service broadcaster shown in Figure 4, the headline reads "Corona came, but for almost a year Denmark has not had excess mortality. This is about to change", which is combined with the subtitle "Denmark is one of the few European countries that has avoided excess mortality for a long time" (translations from Danish by the authors). The textual message praises the performance of Denmark, and it is reinforced by the chart, where the choice of countries and colors hints to a sense of comfort for Danish residents, Denmark being depicted in blue, and other European countries with clear excess mortality visualized in pink, red, and dark red.
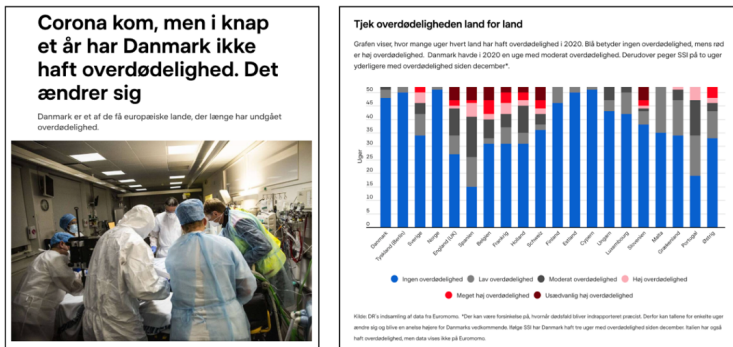

Figure 4: A Danish example of a warning in the title, and the visualization with comparisons between countries and colors hinting to a sense of comfort for Danish residents (Kildall Rysgaard, 2021). Translated from to English, the two captions read: "Corona came, but for almost a year Denmark has had no excess mortality. This is about to change" and "Check excess mortality country by country".

Another of our findings concerns how casualties are depicted by different countries. Across the sample, line charts were the most common type of visualization. However, depending on the country, we also observed significant differences in how scale was used in line charts. In Denmark, Germany, and Norway, it was more common to find line charts with the maximum value plotted over the maximum value provided by the scale (Figure 5). In Czechia, Sweden, Spain, and the UK, it was more common to find the maximum value in the

data under the highest scale value, creating a subtle effect of diminishing the number of dead.
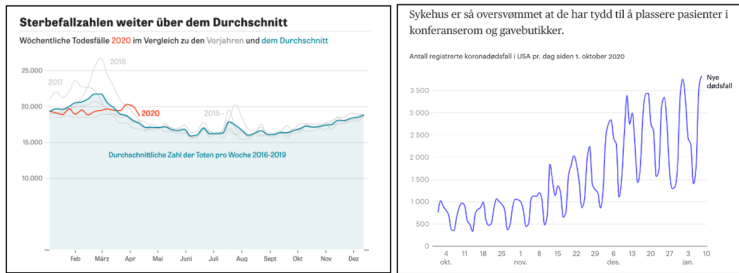

Figure 5: Examples of charts with the value above the last tick of the scale, the graph to the left from Germany (Ehmann et al., 2020) and to the right from Norway (Selbo Torset and Gausen, 2021). Translated to English, the two captions read: "Numbers of deaths again over the average: weekly reported deaths for 2020 in comparison with the previous year and the average", and "Hospitals are so overwhelmed that they have resorted to placing patients in conference rooms and gift shops."

Our results are in line with previous research that points to the fact that the dissemination and delivery of content online are not neutral activities (Tewksbury and Riles 2018, p. 138). Scale manipulation is a prominent example of what Huff (1954) denotes as statisticulation (i.e., misinforming someone using statistical material). We suggest that representing the maximum data point under the scale can be used to diminish the dramatic number of fatalities, while plotting the maximum number of deaths above the maximum range could be used to increase the sensation that the number of fatalities is high, and above an anticipated level.

Journalistic considerations behind why these attributes were used to change the visualizations are outside the scope of this study; however, we argue that if understanding a visualization of death comes with a higher level of concern, as suggested by Romano et al. (2020), the design choices made by journalists in this context may have had an impact on how audiences reflected on and felt about the overall message in the article. Therefore, these choices, if deliberate, could mirror current ethical considerations and long-standing practices in journalism related to death. Future research could investigate these ethical considerations that journalists make when designing charts in times of crisis.

These findings raise two main points. First, data visualization is far from being an objective and neutral representation of data, especially within the journalistic domain. Second, national debates and social expectations, in addition to rational or technical choices,

influence the design of these visual artifacts. In countries like Denmark or Norway, where COVID-19 has been treated as a foreign disease with little domestic impact, comparisons between other countries are frequent. For others, such as Sweden and the Czech Republic, where the death toll at specific points in time soared, our results indicate that the number of casualties seems to be systematically downplayed. The decision to downplay the death toll in countries that suffered a high number of deaths at certain points in time might have been based on deliberate journalistic ethical decision-making – possibly following existing ethical guidelines on how to deal with death in journalistic coverage (Frazer 1992). Ultimately, these visualizations seem to be built to support the national narrative on the pandemic and are similar to how journalism traditionally supported national efforts in times of war (Hanusch 2010).

Conclusions

Our results illustrate how journalists in ten European countries choose to visualize death by COVID-19 as the pandemic progressed. Coleman (2010, p.237), inspired by Entman (1993), argues that visual framing in hybrid visuals such as maps and graphics, much like text, also "selects some aspects of a perceived reality and makes them more salient [..]". Framing is not only about text but includes many journalistic choices of visual cues that will convey a message.

In this study, we have explored how death was represented in online articles focused on COVID-19-related deaths in ten European countries. Our analysis focused on finding differences between the various types of representations as well as similarities, with a specific focus on national and international COVID-19-related deaths. The difference between national and international is also a key-aspect of journalism in times of war. We found that the pandemic often was portrayed as a war with fear-inducing language for both textual and visual elements. In particular, this was noticed in representing national deaths compared to international ones. We also found indications that deaths at times were subtly diminished or dramatized in visualizations, similar to how journalism in times of war often treats domestic deaths with more care, compared to international fatalities.

In general, the topic of death seemed to be visualized with basic graphs and few variables. Nuance is there, but it takes dubious form. While it seems like journalists were striving to strengthen data literacy among their audiences using visualizations to explain the complex nature of the pandemic, they were also using techniques of statisticulation to distract readers from national death counts as a

comforting strategy throughout the crisis. International deaths have been presented as crude numbers, whereas the portrayal of national deaths was equipped with socio-demographic context, with a slightly stronger emotional aspect. One limitation of the study is posed by how visualizations were analyzed. The coding process happened on desktop computers, whereas a lot of data journalism is now produced with mobile phones and social media in mind. It is possible that interactivity or complexity might have been disregarded by journalists, making the visualizations simpler to fit distinct types of platforms such as mobile. These aspects are difficult to study. Methodologies for content analysis that focus on mobile devices are still rare in journalism studies.

Even though the pandemic is a global phenomenon and journalism about the pandemic spanned national borders, for journalists the importance of their "own" nation, similar to frames in journalism about war, seemed to be key. Because public data often are released with a geographical component, such as country, region or municipality, these data are easy to obtain and represent, especially on maps. However, such visual geographical representation brings an inevitable element of comparison, or, as Aiello et al. (2022) suggest, competition. We suggest that in the context of COVID-19 visualizations, a low death toll became a success factor. In countries that suffered a large number of fatalities, a high death toll could be compensated through either visual edits such as scale adjustments, or a change of metrics. The use of other kinds of death measures, such as excess mortality, also helped to diminish the effect. We found that in this competition, similar to journalism in times of war, journalists' own nation had to "win" against other countries, even if their death toll was considerably higher.

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