

1 VISUAL PORTRAYALS OF FUN IN THE SUN IN EUROPEAN NEWS OUTLETS MISREPRESENT HEATWAVE RISKS

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Authors:

Saffron O'Neill (Corresponding author)

Geography, College of Life and Environmental Sciences, University of Exeter, Exeter, UK.

Email: s.oneill@exeter.ac.uk

Sylvia Hayes

Geography, College of Life and Environmental Sciences, University of Exeter, Exeter, UK.

Nadine Strauß

Department of Communication and Media Research, University of Zurich, Zurich, Switzerland

Marie-Noëlle Doutreix

ICOM, Communication Institute, University of Lyon, Lyon, France.

Katharine Steentjes

Centre for Climate Change and Social Transformations, School of Psychology, Cardiff University, Cardiff, UK

Joshua Ettinger

School of Geography and Environment, University of Oxford, Oxford, UK.

Ned Westood

Environmental Intelligence, College of Engineering, Mathematics and Physical Sciences, University of Exeter, Exeter, UK.

James Painter

School of Geography and Environment, University of Oxford, Oxford, UK.

Reuters Institute for the Study of Journalism, University of Oxford, Oxford, UK

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Abstract: The ways in which news media communicate about heatwaves can influence how society conceptualises and addresses heatwave risks. We examined visual news coverage of the 2019 heatwaves in France, Germany, the Netherlands and UK, using content and visual

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critical discourse analyses. Many visuals were positively valenced (in contrast to article texts), framing heatwaves as ‘fun in the sun’. The most prevalent type of images in all countries were photographs of people having fun in or by water. When images did depict the danger of heat extremes, people were largely absent. We conclude that this visual framing of heatwaves is problematic: first, by displacing concerns of vulnerability, it marginalises the experiences of those vulnerable to heatwaves; and second, it excludes opportunities for imagining a more resilient future. We conclude with suggestions to diversify the visual discourse on climate change and heatwaves in the news media.

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2 INTRODUCTION

Heatwaves are becoming longer, more frequent and more intense due to climate change (IPCC 2021). The impacts of extreme heat are unevenly experienced; with older people and young children, those with pre-existing medical conditions and on low incomes significantly more vulnerable (PHE 2019). Adaptation to heatwaves is therefore a significant public policy concern, but yet one where the risks remain largely invisible (Brimicombe et al. 2021). Indeed, a significant concern raised via interview research with at-risk people in the UK is that even vulnerable people do not perceive themselves as at risk of extreme heat; therefore, early warnings of extreme heat events do not perform as intended to reduce vulnerability (Wolf et al. 2010).

This suggests that understanding how extreme heat is narrated, conceptualised and visualised is an important part of working towards effective adaptation. The news media play a central role in this process: both by shaping how people think and feel, but also by reflecting and representing something of how society conceptualises the issue of extreme heat. The news media are the dominant source, in most countries, for information about climate change (Schäfer and Painter 2020, Amdi 2020). News stories about extreme weather risks can help to warn people about the potential danger to themselves and those close to them, as well as about impacts on infrastructure and society more widely (Painter et al. 2020).

The volume of media coverage an issue receives can have an agenda setting effect, as topics that receive more coverage can lead audiences to assign greater importance to them (Liu et al. 2011). The framing of coverage can also influence audience engagement, which has been shown in a variety of contexts including extreme weather (Ettinger et al. 2021). Framing is the process whereby certain aspects of an issue are emphasised, and others de-emphasised, in any topic discussion (Entman 1993). It is an inevitable consequence of the news process, but it is important to recognise that framing (whether intentional or not) produces particular effects: for example, dominant framings can privilege particular actors, impact media attention, and influence public opinion and policy options (Nisbet and Hoge 2006). In terms of climate coverage, longitudinal research suggests that a small but consistent amount of news attention is given, on average, to climate change. Political events act as focussing events, resulting in peaks in issue attention; but economic or cultural events have inconsistent impacts on attention (Hase et al. 2021). In terms of content, climate media coverage tends to focus on the negative impacts of the issue, or on political controversy (Boykoff 2011) rather than of stories about opportunities and adaptation.

Geographers have a long-standing interest in the visual (Driver 2003, Rose 2003). Yet whilst there has been considerable attention paid to how the news media represent climate risk in textual form, and what this may mean for public engagement, there has been considerably less attention paid to visual imagery within news reports (O'Neill 2013). More specifically, the textual content of extreme weather events in the news media has more recently received growing attention (Hopke, 2020; Painter et al. 2021), whereas understanding of visual communication of extremes is sparse (Nerlich and Jaspal 2013). However, images play a key role in communication. Images have particular communicative qualities: they are often vivid

and emotive (Joffe 2008), drawing viewers to a story and helping them to remember it (Graber 1990).

Images also play a key role in climate engagement: influencing peoples' emotional responses and

their behavioural intentions (Leiserowitz 2006, O'Neill and Smith 2014). Furthermore, images are a key component of media portrayals of climate risk. For example, the availability (or lack) of compelling imagery is central to editorial decision-making (Bennet 2011), including for climate change news: if compelling imagery is lacking, then a climate news story may be pulled from the news outlet (O'Neill et al. 2015). There may be a conflict, then, between images which are perceived as newsworthy and compelling (which help a story about extreme weather and climate change break into the news – such as people having fun at the beach) and images which visually portray the risks associated with the extreme event (for example, elderly people struggling to cope in extreme heat). There may also be a conflict between the different communicative forms in a news report: DiFrancesco and Young (2011) found climate news article content often pulled in different narrative directions, with article text and images making unrelated or sometimes even contradictory claims.

In the same way that framing is an inevitable consequence of textual communication, framing is an inevitable part of visual communication – it is impossible to capture reality in one image (Messaris and Abraham 2001). Visual framing includes a photojournalist's decision of what to include (and exclude) in the camera frame (literally 'framing' the image); but also decisions by news editors in selecting images from vast, ever-updating global image collections; and by the algorithmic decisions that underlie online image search results. As with text, the visual framing process is highly ideological (Hall 1973); but unlike text, visual clues often go unnoticed or unchallenged. For example, racist or ideological views have been visually portrayed in news reports that would 'never pass newsroom muster' in textual form (Coleman 2010:235). Climate change visual representations, therefore, are part of the cultural politics of climate change (Boykoff, 2011); where the repetition and normalisation of certain types of visuals (and the absence of others) enables (or withholds) power from particular voices.

Through their circulation, repetition, and reinterpretation, images have helped put climate change on the political agenda (Doyle 2019), with visualisation central to making problems demonstrable and actionable (Balayannis and Garnett 2020). For example, red colours in

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climate model outputs connote risk and danger, and are used as a political call to action (Schneider and Nocke 2017); whilst dark red is linked with increased threat and intention to act in emergency management, such as in tornado warnings (Ash et al., 2014). But images can also lead to inaction: the dominance of the politicised and contested visual framing in climate news can leave people feeling powerless to act (O'Neill et al. 2013). Similarly, photographs of climate impacts commonly depict climate change in spatially and conceptually distant places (O'Neill 2013), decreasing a sense of self-efficacy (O'Neill et al. 2013). Thus, images have considerable power in helping us think, sense, and imagine climate change (Schneider and Nocke 2014, Yusoff and Gabrys 2011). Images can open up - or foreclose - possibilities, and become blueprints for future realities (Schneider and Nocke 2014). What reality, which future, then, is encountered in the visual reporting of news about heatwaves and climate change?

3 METHOD

Four countries (France, Germany, the Netherlands and the UK) were chosen as they were most impacted by the 2019 European heatwaves (Painter et al. 2021). Data was collected from online websites in each country, as they represent the second-most consulted source of information about climate change, after TV (Amdi 2020). For each country, we analysed the coverage of five of the most visited online news sites (i.e. wide reach), for diversity of type ('up market', tabloid and broadcast) and for political orientation. Each country sample included at least one left-leaning and one right-leaning title, and at least one broadcast company (see Supplementary Information 1, Painter et al. 2021). The sampling period ran from 01 June to 30 September 2019 and captured two periods of extreme hot weather in all countries: heatwaves in France, from 24 June-7 July and 21-27 July; in Germany, a heatwave from 4-26 July and the warmest June since records began; in the UK, heatwaves from 21-28 July and 23-29 August; and in the Netherlands, heatwaves from 22-27 July and 23-28 August.

Articles were selected for inclusion in the dataset by searching for the term 'heatwave' in UK media and its equivalents in German ('Hitzwelle'), French ('canicule', 'vague de chaleur') and Dutch ('hittegolf') media and collecting all news articles which were substantively about the 2019 heatwaves. Only articles where a link was made to climate change (even if briefly) were included for analysis. Narrowing the sample to these articles reflects the overall justification for this study: responsible visual discourse around extreme heat risks is highly relevant to the increasing impacts of climate change on heatwaves around the world. Articles were excluded where links were broken (as of October 2021). News articles where there was either no image,

or a video which played automatically (i.e. no static image on opening the webpage) were deleted. The first image on the page (also known as lead or hero image) was collected. This resulted in a dataset of n=245 images and their associated articles.

3.1 Thematic and valence coding

A reflexive and mixed-methods approach was followed to explore the visual framing of heatwaves in the media. Entman (1993:52) defines framing as the process of ‘selecting some aspects of a perceived reality and making them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation’. As with critical discourse analysis, framing is concerned with power and the construction of meaning in texts (van Dijk 1993) but framing also retains a focus and close reading on particularly salient examples at the analysis stage.

A visual content analysis was designed to capture the image corpus at a broad level, examining the images for their denotative content. This provides an overview of a domain of visual representation. Then, an understanding of the connotative content of images (how the objects portrayed relate to culture, seeking to understand structures of meaning) as well as their ideological content (how the image is read, how intrinsic meanings come to exist) helped to place the images in their socio-political context (Dyer 1982). Close reading of representative individual images or image groups elucidates these processes.

A codebook was drawn up by the first two authors qualitatively and inductively, with reference to a range of literature on visual (climate) communication (including O’Neill 2013, O’Neill et al. 2015, Rose 2016, Rebisch-Hespanha and Rice 2016, Schneider and Nocke 2017, Hayes and O’Neill 2021). Valence coding drew on Lang et al. (1990) and Lehman et al. (2019). Valence was used to describe the emotional quality of an image or text – whether it appeared negative (worrying, risky, dangerous, inconvenient) or positive (fun, enjoyable, holiday-like, relaxing) in the context of a news media story about a heatwave. Image valence coding also accounted for images with mixed or neither valence (both positive and negative elements; or no obvious valence signalling, respectively). The resulting themes and valence coding instructions were then refined with reference to an initial sample of images. A spreadsheet was created to record a unique article identifier, the media organisation, article URL, and coding of themes and sub-themes, and image and text valence. The codebook was shared with the wider team, and further iterative refinements were made to clarify meanings and delineate differences between the

thematic codes, image valence and text valence; and to ensure the codebook worked across the socio-political contexts of each of the four countries.

Images were multiple-coded, i.e. there was no hierarchy of image themes or sub-themes - visual cues which were indicative of a particular sub-code were coded as they arose across all images. Multiple-coding was a way of recognising that images can hold different (sometimes contrasting, sometimes reinforcing) meanings. Valence coding also aided in capturing contrasting meanings ('mixed' valence).

Once agreement was reached on the codebook, four coders (one per country) independently coded a random sample of 20 images and their associated article text as a check for inter-coder reliability. This was calculated as an assurance that visual and textual data collected across the four countries was coded consistently, so national-level results could be cross-compared in analysis (O'Connor and Joffe 2020). We recognise the arguments around the epistemologically problematic nature of an inter-coder reliability for qualitative work; here, we use the measure of 'reliability' as proxy for 'trustworthiness' (Braun and Clarke 2013). It is not that this research sought a positivist objective 'truthful' reading of images (recognising that images can have multiple readings; although noting that there does appear to be a dominant reading of climate images in western European nations; O'Neill et al. 2013, Metag et al. 2016) but that, as a team, there was confidence we were analysing the data using a common conceptual framework with reference to both the literature on climate and risk communication, as well as our own experiences and understandings (O'Connor and Joffe 2020).

Using a distance function calculation that is appropriate for multi-label data, Krippendorff's alpha for thematic coding of the images was 0.74. Krippendorff's alpha for image valence was 0.78. Krippendorff's alpha for text valence was 1.00. These results were regarded as reaching a satisfactory level of inter-coder reliability. However, to further ensure consistency, the team met to work through any disagreements in the pilot image themes or valence, making final refinements to the coding scheme. For the full codebook, containing thematic and valencing coding descriptions, and example images and texts, see Supplementary Information 2. Box 1 (below) describes the overarching codes and sub-codes. Note that this coding schema is limited to the western European context examined here. The four country coders used the codebook to code their country sample. The lead author checked for consistency across each country dataset, with any queries discussed. This resulted in a small number of changes to coding.

Box 1. Visual framing schema. Thematic coding in light grey, valence coding in dark grey.

CODE	SUB-CODES	DESCRIPTION
Idea of heat	Sunbeams, starbursts, images suffused with light Weather map Thermometer or a digital temperature display Fire and firefighting Thunderstorms	Images using visual cues to convey the feeling of extreme heat and/or brightness (including sunbeams, starbursts, thermometers, flames, lightning).
Leisure activities in the sun	Leisure activity in or by water Leisure activity in an outdoor, public space Eating and drinking in the sunshine	Images depicting leisure activities taking place outside (including by the sea, rivers, lakes, parks, cafes).
Landscape	Cracked earth Agriculture	Images depicting the impact of extreme heat on land surface features (including rivers, arable land).
Impact of heat	Health and wellbeing Transport Hydration	Images depicting the direct effects of extreme heat (including on health and well-being; infrastructure).
Buildings or structures	Iconic buildings or structures	Images are often used as a geographical locators (e.g. the Eiffel tower to indicate France)
Identifiable person	Identifiable person, may be named in the caption	
Other	Images not coded elsewhere	
Image Valence	Positive, Negative, Mixed or Neither	Positive valence: fun, enjoyable, holiday-like, relaxing Negative valence: dangerous worrying, risky, inconvenient
Text Valence	Positive or Any other valence	Mixed: both positive and negative elements present Neither: no valence signalling

At the analysis stage, the major themes and sub-themes of the coding schema remained largely consistent, reflecting the significant level of reflexivity, pre-planning, training and discussion there had been in preparing the codebook. Quantitative analyses undertaken included calculating percentage coverage for all codes/sub-codes and their valence.

The use of a data visualisation method via the application ImageJ through the macro ImagePlot (<http://lab.softwarestudies.com/p/imageplot.html>; see also Rose and Willis, 2019) allowed for a ‘birds-eye’ view of two key image properties: hue (i.e. red, orange, yellow, or so on, or a

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combination of these) and brightness (i.e. how much light is radiated or reflected) across both the main visual themes. ImageJ has built-in functionality to measure colour hue (RGB values) and brightness (Grayscale average of RGB values) for each pixel. ImageJ calculates a median average for all pixels in the image, then the ImagePlot macro is used to plot images on a colour wheel according to these values, with brightness on the x-axis and colour hue on the y-axis.

Results from the visual content analysis and digital image visualisations were used alongside readings of individual images and image sub/theme groups, to answer the following research questions:

1. How are heatwaves visually framed in media articles about climate change and extreme heat?
2. Does the valence of textual and visual portrayals of heatwaves differ?
3. How do media portrayals of extreme heat reflect wider societal engagement on heatwaves specifically, and climate change more generally?

4 RESULTS

Across all four countries, the most common codes were 'leisure activities in the sun', 'idea of heat', 'impact of heat' and 'landscape' images (Fig.1.). Where percentages are given, these refer to the percentage of coverage per country. Note that images could be multiple-coded, as visuals can depict multiple storylines or narratives (see Method), so the codes do not sum to 100%.

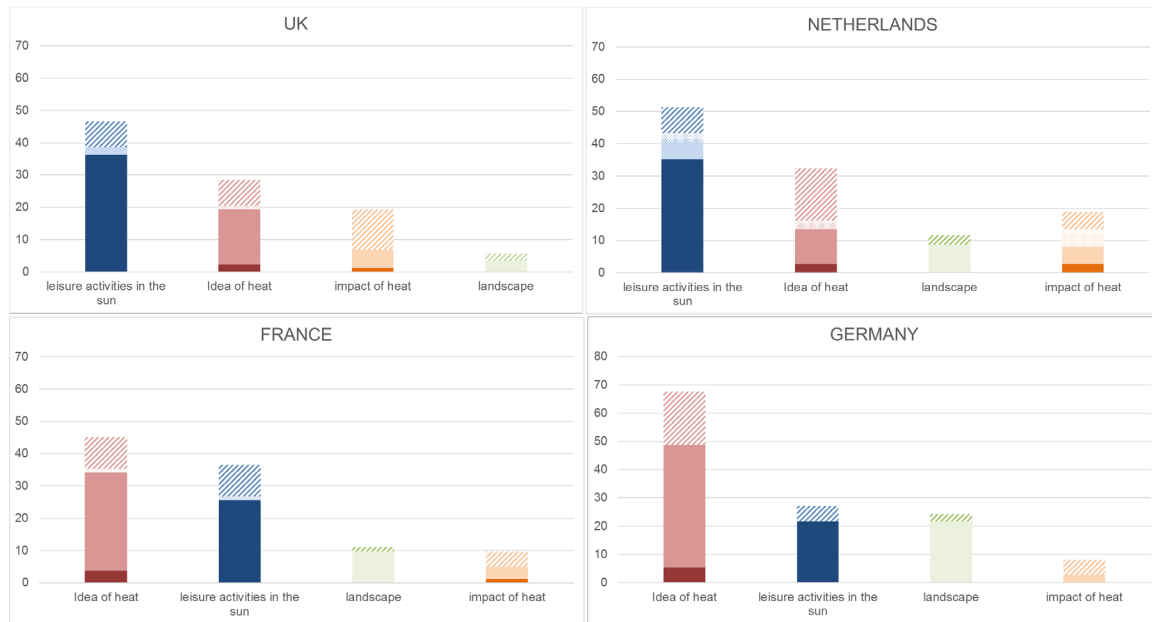


Fig. 1. Major thematic codes by valence, by country. Positively valenced counts are dark coloured, negatively valenced are light coloured, mixed valence are stippled and neither valence are hashed. Y axis is percentage (%) of images by code and valence. Note that images could be multiple-coded.

4.1 All countries commonly visually represent heatwaves as ‘fun in the sun’

All four countries, and especially the UK and Netherlands, extensively depicted heatwaves through a visual repertoire of ‘leisure activities in the sun’ (Fig. 2). This included leisure activities in or by water, or in outdoor spaces, as well as images of eating and drinking in the sunshine. Positively valenced images dominated, giving an overall visual depiction of ‘fun in the sun’. Although there were some images in this thematic code with neither valence, there were very few images coded here with negative valencing (see also Fig.1). The ImagePlot analysis reveals how blue hues, depicting sunny skies and azure water, were common across this theme (Fig. 3).



Fig. 2. All images across the four countries in the 'leisure activities in the sun' code, clustered by sub-code ('leisure activities in or by water', 'leisure activities in an outdoor, public space', 'eating and drinking in the sunshine'). Note how sub-code 'activities in or by water' (top group of images) dominates this code.

Positively valenced leisure activities in or by water were by far the most common sub-code, with images of swimming, sunbathing, splashing in fountains and so on accounting for 33% of UK, 27% of Dutch, 26% of French and 22% of German coverage. These were the sorts of images which used well-worn visual clichés and references similar to a 'holiday snap' (Rose 2010; Fig.4). The images often depicted sociable groups of people, expressing happiness and enjoyment through their faces and body language: smiling and laughing, whilst hugging, playing, holding hands, even jumping with joy. The images were light-filled, featured blue skies and seas, and colourful leisure paraphernalia. As Paris experienced record-breaking temperatures, many people swam in the fountains in front of the Eiffel Tower – leading to repeats of this iconic visual motif in coverage across all four countries.



Fig. 3. Median colour hue (y-axis) and brightness (x-axis). Blue hues, depicting sunny skies and azure water were common in the ‘leisure activities in the sun’ theme. The green hues towards the top of the wheel (12 o’clock) were where the few images coded in ‘leisure activities in an outdoor, public space’ and ‘eating and drinking in the sunshine’ were located. Plotted using ImagePlot (<http://lab.softwarestudies.com/p/imageplot.html>)

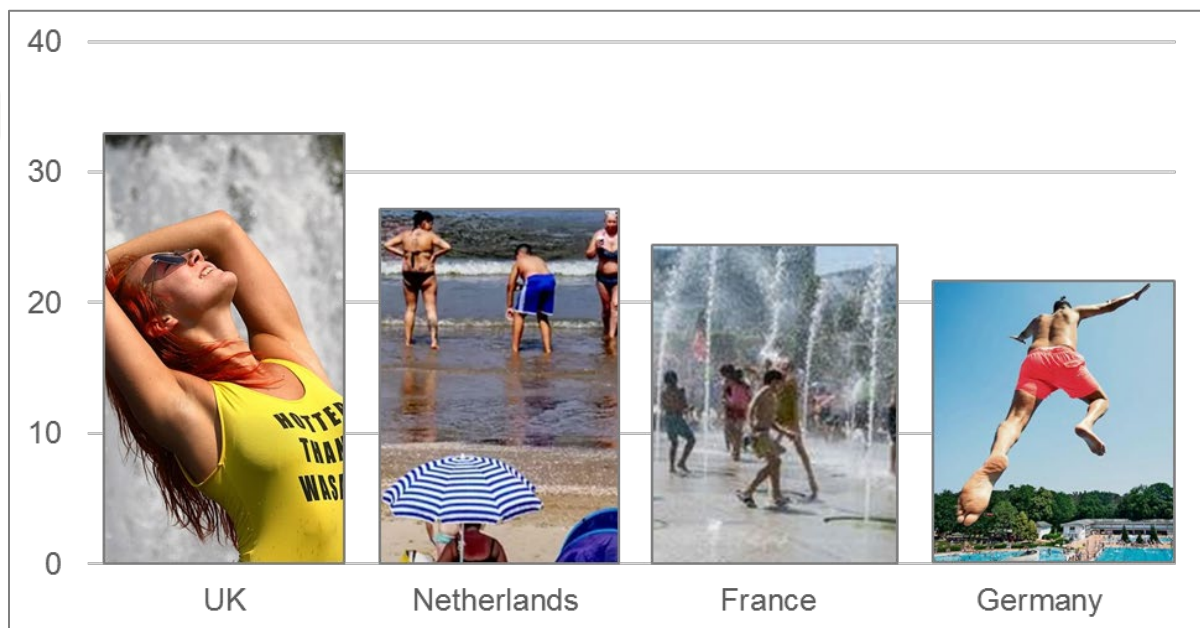


Fig. 4. Percentage of media images depicting the percentage of positively valenced ‘leisure activities in or by water’, by country. The figure’s bars use part of a typical image from each country’s dataset (see ‘a dissonance between texts and images’ discussion).

4.2 Visuals depicting the ‘idea of heat’ were more common in German and French coverage

German and French coverage used visual tropes from the ‘idea of heat’ code far more than the UK and Netherlands (German 68%, French 45%, Netherlands 32%, UK 28%; Fig. 1). The ‘idea of heat’ included images depicting bright white sunbursts, and intense heat through ‘dangerous’ (Schneider and Nocke 2017) orange and red colours (Fig. 5). Thermometers depicting unusually high readings were also common (Box 1, Fig. 6). A small amount of wildfire imagery was also present (0-7% across the four countries). People were far less prevalent in this theme. When people were pictured, they were mostly de-personalised; in shadow, silhouetted against the sun, with faces rarely visible.



Fig.5. Median colour hue (y-axis) and brightness (x-axis). The ‘idea of heat’ included images depicting bright white sunbursts and intense heat through ‘dangerous’ orange and red hues. These two types of visual are clearly delineated on the colour wheel at 7-9 o’clock and 1-3 o’clock respectively. Plotted using ImagePlot (<http://lab.softwarestudies.com/p/imageplot.html>).

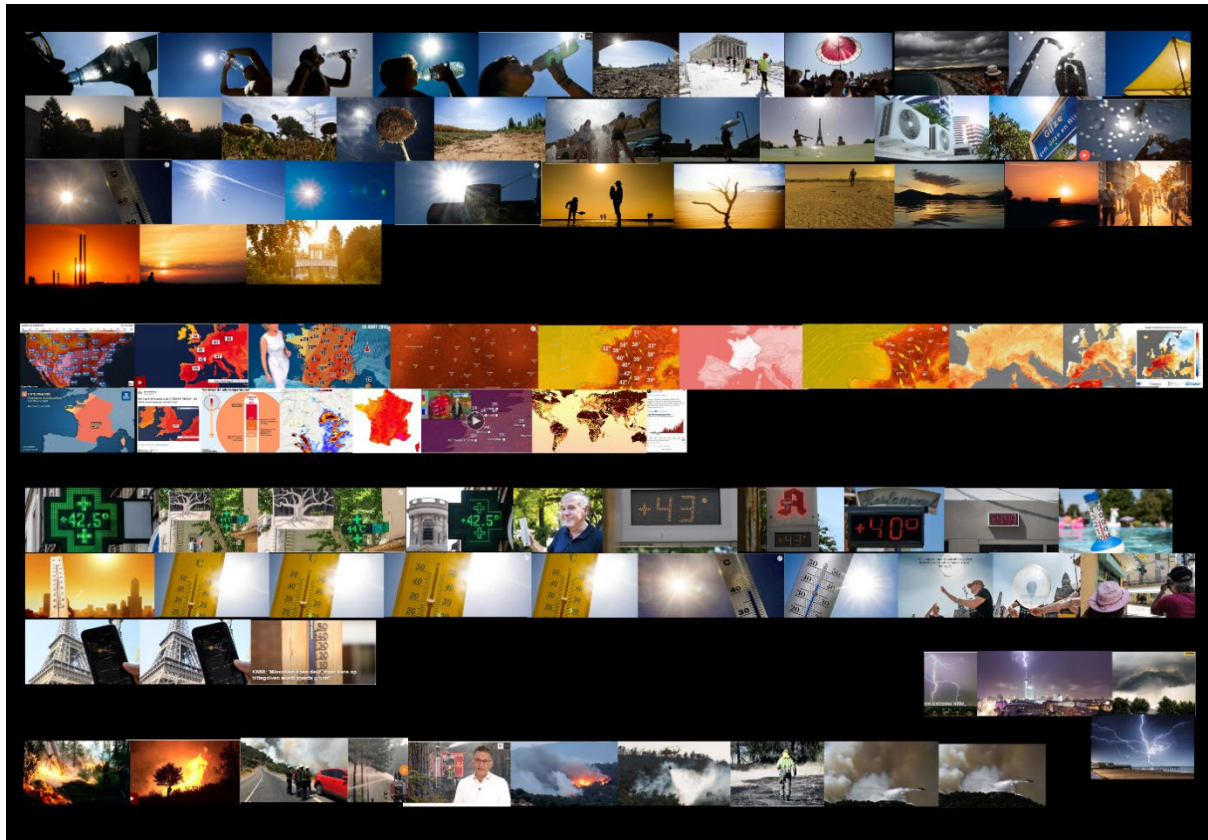


Fig.6. All images across the four countries in the ‘idea of heat’ code, clustered by sub-code (sunbeams, thermometers, weather map, fire, thunderstorm).

4.3 A dissonance between texts and images

There is a dissonance between the valence of the newspaper texts and images. The valence of accompanying text across all countries was rarely positively valenced (<1%). Yet, almost a third of images were positively valenced across the four countries (31%), with considerable variation between countries (Fig. 7). The images used to fill the bars of Fig. 4 are discussed further as exemplars (see Supplementary Information 3 for uncropped images).

In the Netherlands, a headline ‘Red Cross: Municipalities must prepare vulnerable people for heat’ in the news website NU.nl, accompanies a holiday snap image of people paddling at the beach (Fig.4, Netherlands bar). Perhaps some of those who are vulnerable can make it to the beach to deal with extreme heat, but it is surely not a viable adaptation strategy for many others at risk. In Germany, a headline in the tabloid newspaper Bild, ‘Hottest June ever – worldwide’ accompanies a detailed article about the danger of climate change and heatwaves, including even an infographic depicting how climate change will threaten iconic species like polar bears and places like the Great Barrier Reef. Yet the lead image accompanying it is of a holiday snap

- a man jumping from a diving board into a swimming pool (Fig.4, Germany bar). The French and UK examples present the most striking contrasts between text and image valence. On the website of French media organisation 20 minutes, the headline and sub-heading ran: ‘Heatwave: What do the four levels of the national plan provide? HEAT The national heat wave plan was created after 2003 and the tragic summer during which 15,000 people died due to very high temperatures’. It accompanied a picture of children and young people playing in a city splash park (Fig.4, France bar). In the UK, an attractive, smiling young woman leans back into a city fountain, her top displaying the double entendre ‘hotter than wasabi’ (Fig.4, UK bar). It accompanies a Daily Mail article headline which begins: ‘Hotter than hell! ‘Vicious’ Saharan Bubble heatwave roasting Europe kills three swimmers’.

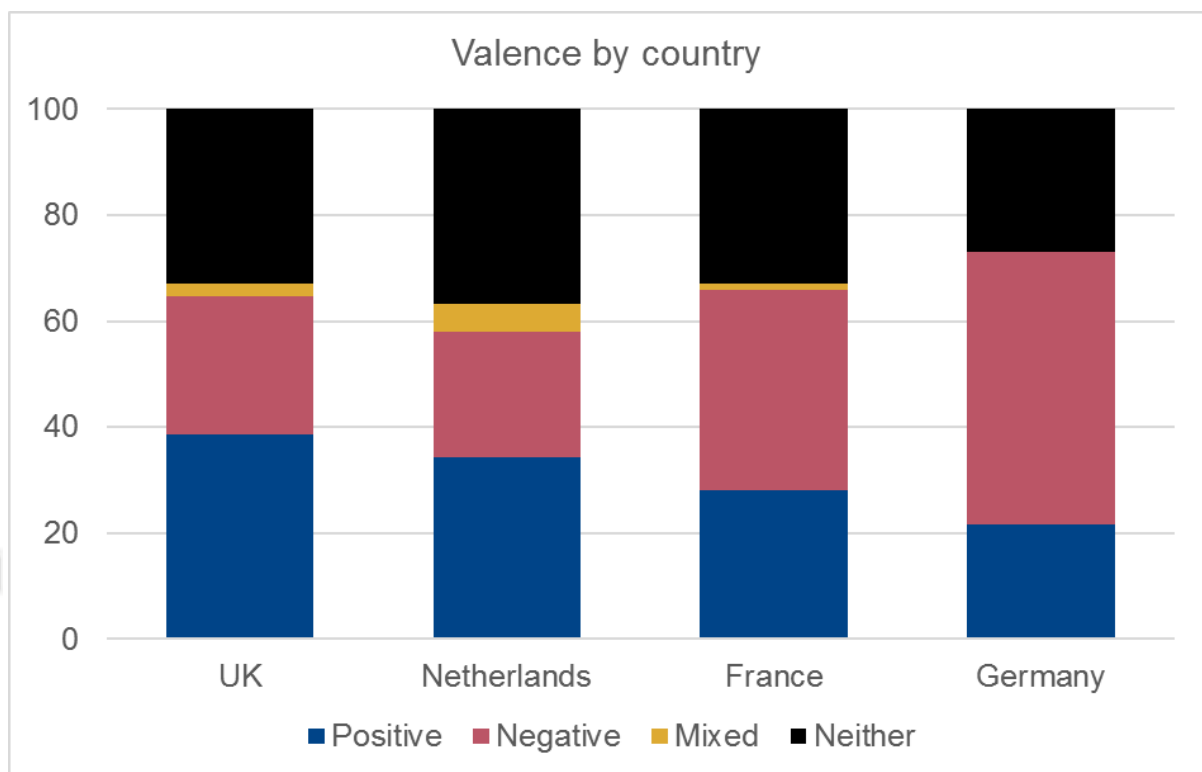


Fig. 7. Percentage (%) of images coded by valence, per country.

4.4 Nascent climate solutions journalism

Historically, ‘climate solutions’ (broadly defined as positive stories of opportunities, adaptation or solutions) have received much less attention than those focusing on negative impacts, despite the potential of solutions journalism for increasing climate engagement (O’Neill et al. 2015, Hulme 2009, Doulton and Brown 2009, Painter 2013). One study showed for example that positive adaptation stories only represented 2% of climate reporting (Moser

and Boykoff 2013). In the present study, climate solutions imagery was absent throughout almost the entire dataset, except for one outlet - the Netherlands local and regional news organisation *Algemeen Dagblad* (AD). AD used visuals coded under 'health and wellbeing' or 'other' far more than other outlets (see Supplementary Information 4 for links to images). For example, although AD used the visual cue for hot weather of people eating ice-creams, the people depicted were elderly residents inside a care home, rather than young families queuing at an ice-cream van on a benign sunny day. When AD depicted a young family, they weren't escaping the heatwave with a holiday to the beach, but were pictured in an everyday situation at home - sitting in front of a fan, looking visibly uncomfortable and fed up with the heat. Further examples included an air-conditioned town hall which had been made available for vulnerable people to visit in order to escape the heat; and an urban greening project designed to reduce the urban heat island effect.

5 CONCLUSION

The results of this research have important implications for visual climate communication. First, the media visual discourse of the 2019 heatwave in France, Germany, the Netherlands and the UK, was problematic; and especially as we only included heatwave articles which made mention of climate change. Across all countries, it was common to visually represent heatwaves as 'fun in the sun'. Much coverage featured images of people having fun in the sun at beaches, pools or city fountains. Although heatwaves may offer enjoyment for some, when heatwaves are imagined as high days and holidays, as events to be welcomed and eagerly anticipated, they are displaced from uncomfortable everyday realities of how heatwaves manifest at home, at work, for travel and so on. Another common set of visual cues depicted the 'idea of heat', through bright sunbursts, intense red heat maps, and high readings on thermometers. At least in these images, the negative aspects of extreme heat are visually cued. But in this visual theme, people are largely excluded. Whilst danger might be implicit, people are still marginalised - not to mention impacts of extreme heat on animals, plants, and other non-humans. Yet heatwaves are understood not only as physical processes of energy transfer, as portrayed in the 'idea of heat' theme, but also in bodily sensations, memory, language and imagination (Abrahamson et al. 2008). This 'distancing' visual framing is common in the news media (O'Neill 2020); and is also reflected in public perceptions of climate change as an issue which can be abstract and distant (Wang et al. 2019).

Both of these depictions are concerning in media coverage about heatwaves and climate change. Those most vulnerable to the impacts of extreme heat are excluded and voiceless, the real concerns for threats to their health and wellbeing during extreme heat events marginalised. It is also a lost opportunity for dialogue around who is vulnerable and how to reduce vulnerability. A study with chronically ill elderly people (i.e. those at higher risk of extreme heat) found that they do not perceive themselves as at risk from heat extremes (Wolf et al. 2010). Indeed, that study's participants suggested media storylines could usefully centre and humanise information about heat risk, instead of relying on traditional weather warnings (Abrahamson et al. 2008).

Second, our results show that there is a dissonance between images and text for media heatwave coverage. Almost a third of all images were positively valenced, yet hardly any texts were. Images and text advanced contrasting narratives of heat extremes. Media outlets are increasingly working towards more responsible and accurate coverage of climate change – for example, there are far fewer occasions now where the journalistic norm of balanced reporting contributes to informationally biased coverage, unlike in the early 2000s when 'balance as bias' was far more prevalent (Boykoff and Boykoff 2004, McAllister et al. 2021). However, there is clearly a problem with the visual imagery accompanying media narratives of heatwaves and climate, if holiday snaps are considered appropriate visual representations alongside news reports of heatwave vulnerability and even deaths.

The image-text dissonance echoes the findings of DiFrancesco and Young (2011) who found images and text pulling in different narrative directions in their study of climate change news in Canadian print media. They hypothesised that this could be due to editors, rather than article journalists, attaching the images post-facto to articles; and editors choosing images for their edgy qualities rather than their match to the text. Indeed, news media outputs are a result of complex interactions between macro trends, the organizational meso level, and the micro-level of individual journalists (Shoemaker and Reese 1995). An interview study with journalists highlights the complexity of climate news production and the everyday structures and routines (including the covering of climate news stories by general news reporters rather than environment beat specialists) which might contribute to such effects (Strauß et al. 2021). We hypothesise that the dominance of global image libraries; the fast-paced and competitive nature of online news environment; the way images can drive engagement with a website via thumbnail images; and the news media organisation's social media engagement strategy (e.g.

photographs requested from readers to illustrate a story) may all be key drivers of visual content. These hypotheses of climate text-visual news production deserve further research. Additionally, researchers could usefully investigate audience engagement with the different types of heatwave imagery.

Third, the results of this study raise the question: how can extreme heat be visualised in ways which are sensitive to risks and injustices, but without resorting to a visual discourse of fear (O'Neill and Nicholson-Cole 2009)? The dominance of the current visual narrative around extreme heat disregards the unevenly distributed harms on vulnerable communities and misses an opportunity to imagine different climate-changed futures. It is an opportunity lost to build resilience to heat extremes in everyday life.

There are historical-cultural reasons why particularly northern Europeans might welcome news of an impending period of sunny summer weather (Fox 2005); and at least in the UK, public perceptions of heatwaves were previously associated with positive as well as negative emotions (Taylor et al. 2014). However, extreme heat has now begun to be identified by UK publics as a serious climate risk (Steentjes et al. 2020) and solutions journalism is gaining ground industry-wide (<https://coveringclimatenow.org/resource/climate-solutions/>) and within individual media companies (<https://www.theguardian.com/world/series/the-upside>). So, how could a broader understanding of what heatwaves entail be visualised? How might a space for more hopeful climate futures be imagined? A starting point for this comes from within our own dataset. AD visualised everyday living-with-heat, which will be part of climate adaptation – much more so than being able to escape to the beach or splash in a city fountain during every heatwave. The AD photographs effectively brought climate change, and heat extremes, closer to home; in ways which opened up the visual discourse to concerns of justice and equity. It may be that as a local and regional outlet, AD focused on local stories of how people were coping with the heat, and commissioned freelance photographers for specific images to accompany these stories. As with research showing the important role local TV weathercasters can play in shaping peoples' climate perceptions (Bloodhart et al. 2015), future research could usefully investigate the role of local and regional news organisations as potential change-makers in the climate journalism space, and how their audiences respond to these very different types of solutions-orientated images.

Finally, it would also be illuminating to investigate how heatwave imagery is visualised beyond the European context, and beyond this largely manual analysis of online news. Is 'fun in the

sun' a visual trope used globally, or is it limited to the Global North? How can digital analyses of large numbers of visuals circulating online (what Rose and Willis (2019) define as 'hyper-seeing'), for example, add to understanding? What do other visualisations of heat extremes tell us about how people engage with weather and climate change?

To conclude, current visual portrayals of heatwaves in the European media are problematic for how they displace and marginalise vulnerability, and in how they exclude opportunities for imagining a more resilient future. Media portrayals both shape and reflect society. It is therefore upon us all – not just image collection curators, photojournalists or editors – to critically question visual portrayals of extreme heat and facilitate dialogue about the unequal impacts of these weather events. Co-produced research with such actors could seek ways in which to open up a more inclusive and responsible visual discourse.

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