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Do personal narratives make thematic maps more persuasive? Integrating concrete examples into maps of the social determinants of health

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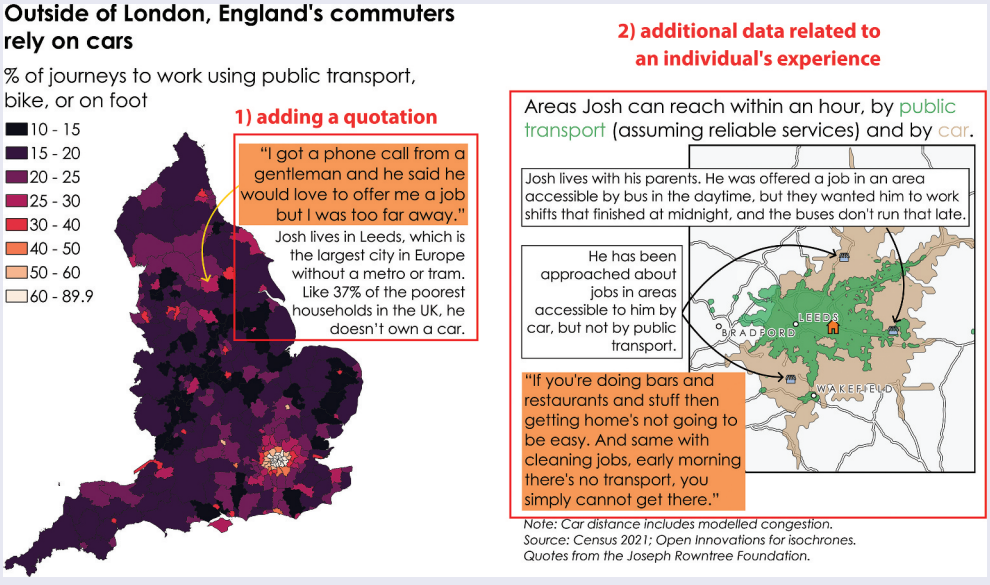
ABSTRACT

Thematic maps about social inequalities can engage audiences, add context to policy debates, and change attitudes toward the issues. The field of communication has long compared the relative persuasiveness of this kind of abstract data versus concrete examples about individuals. While studies have compared the effectiveness of presenting both types of information alongside each other, the line between them is sometimes blurred in data visualization, which can incorporate individuals' stories in innovative ways. One context in which incorporating examples within thematic maps may help is when discussing the social determinants of health because the complex relationship between individual and community is central to how the determinants influence health, and communication on this can be challenging. In this study, we randomly presented the UK public ($N = 389$) with maps incorporating varying levels of "exemplification" for three different social determinants: public transport, air pollution, and youth service provision. We tested how this affected engagement, credibility, and perceptions about the issues. Between-group analysis found few significant differences and therefore limited persuasive power. However, within-subject analysis indicated that the maps with individual-centered stories may be more persuasive but only among those less confident in their ability to interpret data visualizations.

KEY POLICY HIGHLIGHTS

- Maps of social inequalities that incorporate stories about individuals may be more engaging and persuasive to audiences less confident with statistics.
- In data visualization experiments, researchers should consider analyzing both differences between treatment groups and differences within subjects in their responses to different stimuli.



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Introduction

Data visualization can be engaging and persuasive, shifting audiences' attitudes toward topics or changing behaviors (Nyhan & Reifler, 2019). The ability of maps to persuade is well-established (Tyner, 1982), and empirical work has measured what elements make them persuasive in different contexts (Muehlenhaus, 2012).

At the same time, scholarship in communication has long considered the relative persuasiveness of abstract, quantitative information – such as charts and thematic maps – versus vivid, concrete examples (Iyengar, 1991; Zillmann, 1999). Presenting the two types of information alongside each other can in some cases be more effective than presenting either on their own (Hoeken & Hustinx, 2009), and in other cases, the presence of statistical information can reduce counterarguments to specific examples about just one person (Niederdeppe et al., 2016).

However, in cartography, the line between abstract data and concrete examples is sometimes blurred. This is partly reflected in maps that incorporate stories relating to individuals, often on journeys (Fragapane, 2018; Liem et al., 2020; Westerveld & Knowles, 2021). These tend to include quotes from the individuals presented. Maps can also make use of individuals and their experiences as a device to explore more granular data in the setting of a local community. Yet the persuasiveness of maps that incorporate examples about individuals is unclear.

One context in which incorporating individual stories within thematic maps may be especially useful is in communication on the social determinants of health. The social determinants are the conditions in which people are born, live, work, and age. They encompass a wide range of social, economic, and environmental conditions that shape a person's life experiences and access to resources, and "have a greater influence on health than healthcare, behaviors or genetics" (Office for Health Improvement and Disparities, n.d.). However, communicating the role of the social determinants can be challenging (L'Hôte et al., 2018).

According to Lundell et al. (2013a, p. 496) "[the] idea of mutually dependent and reinforcing interactions between individuals and communities … may be important to convey in SDH-related stories." At the same time, combining individual stories and aggregate data can "establish important connections between large-scale phenomena … and the everyday lives of individuals" (Kwan, 2002, p. 650). Such a combination may therefore improve communication by underscoring the ways in which structural factors and individuals' lives interact to shape health. This paper takes an experimental approach to seeing how the integration of specific person-centered examples within thematic maps can change perceptions of social determinants.

We first set out communication problems relating to the social determinants of health. Then, drawing from exemplification theory and the concept of vivid cartography (Fish, 2021), we explain how integrating examples within thematic maps might change perceptions toward the social determinants. We also discuss the potential drawbacks of including this information, such as audiences perceiving the maps with individual perspectives as biased or less credible. Then, we set out our randomized survey experiment, which presented UK participants (N = 389) with information on three social determinants. For each topic, they saw one of three maps which varied by the extent to which they incorporated examples (through the addition of quotes from an individual, and an inset providing more granular data to illustrate their area). By comparing responses to different information types, we gauge how public attitudes are shaped by individual stories incorporated within maps.

Background

The context: communicating the social determinants of health

Reducing health inequalities requires a concerted policy focus on the social determinants of health. These determinants affect health in a variety of ways, such as air pollution or housing quality causing respiratory problems, and job insecurity causing chronic stress which affects physical health over the life course. The social determinants also influence health via individual behaviors, for example green space facilitates exercise, and dietary choices are constrained by factors like income and the local food environment (Smith & Garthwaite, 2015).

Policy intervention here requires a recognition of the central role of the social determinants by both policymakers and the public. Public attitudes matter in shaping public health policy, partly because the sort of large-scale change required to address health inequalities requires broad public support (Mackenbach, 2011; Smith & Garthwaite, 2015). Furthermore, while public health advocacy is traditionally targeted toward policy audiences, there are calls to "[mobilize] the public to force government action" (Raphael et al., 2022, p. 135).

Although there is widespread understanding that the social determinants have a role in influencing health (Smith & Anderson, 2018), the dominant cultural assumption is that health is mostly the result of lifestyle choices that individuals can control (Baum & Fisher, 2014; Lundell et al., 2013b; Macintyre et al., 2005), and

disproportionately little emphasis is placed on the social determinants (L'Hôte et al., 2018). In a survey across eight countries, one study found public attitudes toward the causes of health outcomes are consistently skewed toward individual behavior (Abdalla et al., 2022).

Considering the need to shift public attitudes on the causes of health inequalities, empirical studies have sought to assess communication on the social determinants of health. Maps are central to the communication of both the extent of geographic health inequalities and the social determinants. Creative depictions have included a map of life expectancy along the London Underground stations (Cheshire, 2012) and the U.S. Social Determinants of Health Atlas (Kolak et al., 2020).

While few empirical studies on social determinants communication have assessed map design, some have investigated the presence of maps and charts (Lundell et al., 2013b; Niederdeppe et al., 2016). Lundell et al. (2013a) argued that social determinant messaging needs to convey both complexity (of interconnected causes) and typicality (of the challenges people face). In focus groups, they found that visualizations like scatterplots and choropleth maps sometimes faced accusations of oversimplification – not conveying complexity – while narratives about individuals could be seen as isolated cases – not conveying typicality. Another study presented either individual- or community-based written narratives alongside statistical maps, and found that the presence of a statistical map reduced counterarguments prompted by narratives about just one individual (Niederdeppe et al., 2016). There are ways to further combine these two elements of communication – individual stories and statistical maps – for example using an individual narrative as a hook to showcase granular data in a local community, or with the addition of quotes. This may prove persuasive, and we outline the theoretical justification for this below.

Exemplification and vivid cartography

In the fields of psychology and communication, "exemplification" refers to the use of "concrete, often vividly displayed events" (Zillmann, 1999, p. 70) as opposed to abstract, quantitative information. "Vividness" is defined as information that is "(a) emotionally interesting, (b) concrete and imagery-provoking, and (c) proximate in a sensory, temporal, or spatial way" (Nisbett & Ross, 1980). There is a range of empirical evidence pointing to an exemplification effect, in which these specific examples are more effective at engaging and persuading audiences than base-rate information (Zillmann & Brosius, 2000). This may be because it is easier to visualize an individual's situation, reflected also in the identifiable victim effect (Small et al., 2007).

The exemplification effect does not hold in a number of cases, for example US state legislators were more likely to offer counterarguments to upstream interventions when presented with an individual-level narrative on obesity compared to a community-level one (Niederdeppe et al., 2016). Base-rates have also been shown to matter no less than exemplars in settings in which certain audiences are already highly involved, for example in a study on the US' much-discussed Affordable Care Act (Bergan & Lee, 2019) and in sports highlights when the audience is particularly knowledgeable in sports (Cummins & Hahn, 2022). Nonetheless, the vivid nature of exemplars is generally seen as a strength (Jia & Sundar, 2023).

Inspired by the communication literature, Fish (2021) puts forward the term "vivid cartography," describing how maps of climate change – which are understood as abstract, contextual information – can contain vivid design elements intended to evoke emotion. Climate change and health inequalities share similar communication challenges, as complex problems that require some public understanding (Marshall & Allen, 2023). The elements that Fish refers to include visually representing change over time, projection choices, and novel designs. Novel designs can include interactivity, a design choice that Jia and Sundar (2023) suggest also provides vividness in the case of data visualization more broadly. These works describe how contextual information can themselves be vivid.

Contextual information is often presented alongside specific examples, for example in news pieces which provide statistical context before focusing on individuals. However, in some visual stories the line between these types of information can be fuzzier, and they can provide vividness in a more literal way than suggested by Fish (2021). When mapmakers incorporate stories relating to individuals within statistical maps – through quotations, photographs, or granular data all pertaining to the life of an individual in a community – they may also be making use of vivid design.

Such a combination of aggregated statistics and individual stories can be seen in the work of news outlets' visual storytelling teams. For example, *The Financial Times* illustrated the human impact of bombing in Gaza with a map that combines a damage analysis of satellite data in Gaza and the movements of a single family (Saleh et al., 2024). It is plausible that the effect of the two pieces of information together is greater than the sum of their parts. When looking at the migration of

Democrat versus Republican voters, *The New York Times* used photographs of two real voters from the respective parties to illustrate what a multitude of data points represented, incorporated into what might be described as an animated Sankey diagram (Kaysen & Singer, 2024). This kind of illustration of individual stories within – not just alongside – visualizations of contextual data can also be seen in ArcGIS StoryMaps (Esri, n.d.), popular books (Cheshire & Uberti, 2021), and investigative journalism.

By presenting individuals within the visualizations themselves, these examples add further context to the data. The stimuli created for this study further explore this aspect by providing an inset with more granular data for an individual's local area. This integration may alter how audiences cognitively process the individual example, since it is explicitly linked to the data. Also, charts are now often shared online without the context of their supporting narrative (Harris, 2015), so including exemplars within the image may retain relevant context, similar to how titles provide an editorial angle on visualizations that would otherwise have many possible interpretations (Kong et al., 2018).

However, adding these individual stories to maps may still prove counterproductive for at least two reasons. The first, which is inherent to exemplification of any social issue, is that because examples are not necessarily representative (Zillmann, 1999), there is a perception of bias. The perception that representative exemplars are cherry-picked to make more general statements might invite claims of exaggeration.

Data visualizations themselves only show certain aspects of an issue (D'Ignazio & Klein, 2020) and can be used to exaggerate issues – for example climate change deniers cherry-picking maps (Fish & Kreitzberg, 2023) – but they are nonetheless imbued with a sense of objectivity that other stories are not (Kennedy et al., 2016). It is unclear whether the credibility afforded to these graphics extends to stories about individuals presented within them.

The second reason is that discussing individuals may encourage users to think disproportionately about behavioral causes of health inequalities, a dominant perspective that those communicating structural causes can struggle to compete with (McMahon, 2022). The presentation of concrete examples over abstract thematic data in television news increases the attribution of responsibility on individuals rather than structural factors (Iyengar, 1991). This, in turn, has a negative effect on support for policy solutions focused on the social determinants (Temmann et al., 2021).

While the focus of this research is on persuasion, incorporating individual stories into maps may be valuable for other reasons. Feminist cartographers seek to challenge the perception that maps are objective by showcasing multiple perspectives (Kelly, 2023). Just one of many potential techniques to achieve this is by using quotations, as seen in beautifully constructed depictions of individuals' journeys coupled with quotes, mapping the testimonies of Holocaust survivors (Westerveld & Knowles, 2021) and asylum seekers (Fragapane, 2018). This can aid analysis too, since "the combination of qualitative and quantitative data, together with a commitment to iterative, reflexive rounds of analysis, enables research to be attuned to multiple subjectivities, truths, and meanings" (Knigge & Cope, 2006, p. 2035). These techniques may also be persuasive via increased empathy, as some visualization toolkits suggest (Riche et al., 2018), although there is currently little empirical evidence for these claims (Boy et al., 2017; Liem et al., 2020).

Hypotheses

Table 1 lays out the hypotheses of our study. Given the paper's motivations, our main outcome of interest is whether the information persuaded users that the social determinants should be a policy priority. We hypothesize that greater exemplification within maps will be more persuasive in this context (**H1**).

Our second hypothesis concerns factors that might positively mediate the effect of exemplification on perceptions that the issue is a policy priority (**H2**). One of

Table 1. Study hypotheses.

Hypothesis	Statement
H1: Persuasion	Maps with exemplification will be more persuasive, making users more likely to see the issue as a policy priority.
H2: Positive mediation	The effect of exemplification on the extent to which users see the issue as a policy priority will be mediated by increased engagement, perceived severity, and an understanding of the link between the social determinant and health inequalities.
H3: Negative mediation	The effect of exemplification on persuasion will not be suppressed by a reduction in trust or increased perceptions of manipulation or exaggeration.
H4a: Moderation by chart literacy	The effect of additional exemplification on engagement, comprehension, and persuasion will be greater for those with lower chart literacy.
H4b: Moderation by chart confidence	The effect of additional exemplification on engagement, comprehension, and persuasion will be greater for those with lower confidence in using maps and charts.

these is that greater exemplification will be more engaging. Good data visualization can be engaging anyway (McKenna et al., 2017; Segel & Heer, 2010), so perhaps the maps will attract sufficient attention on their own. However, exemplars are "inherently more colorful [and] engaging" (Sundar, 2003, p. 287) than abstract information. And while Liem et al. (2020) found that maps about immigration with an empathy-focused design had no effect on persuasion, they were more engaging.

Another positive mediator is perceived issue severity. In a study about perceptions of obesity, the effect of interactive visualizations on policy attitudes was mediated by issue severity (Oh et al., 2018). The third mediator is a comprehension of the link between the determinant and health inequalities. An individual story can serve to highlight the mechanisms by which the social determinants operate. Placing individual characters within maps of their local area explicitly draws a link between them and their communities.

It is intuitive that users who are more engaged, more persuaded that the issue is a severe problem, and more convinced on the link between the issue and health inequalities will, in turn, deem it more of a policy priority.

Our third hypothesis concerns the effect of exemplification on trust in the information and possible defensive responses, which could reduce persuasiveness (**H3**). As discussed, exemplification can backfire in written narratives, and maps vary in their perceived trustworthiness too (Prestby, 2025). Users rely on heuristics such as source attribution but also subjective design quality to judge the credibility of data in visualizations (ibid). In simulated news articles, animated maps about climate change were more likely to elicit feelings of journalist bias than static ones, perhaps because the extra work is perceived as "trying too hard" to persuade (Tsang, 2023). It is plausible that the addition of examples about individuals will reduce overall credibility for similar reasons – the mapmaker is trying too hard by including a cherry-picked example. However, since the addition of an example does not necessitate the removal of quantitative data, we hypothesize no change to perceptions of trustworthiness, manipulation, or exaggeration.

Our fourth hypothesis suggests that different audiences may react to the additional exemplification differently. When Cummins and Hahn (2022) presented users with sports highlights, most participants ignored base-rate statistics in favor of exemplary moments from the match. However, those with a greater interest in sports engaged more with the statistics, and greater sports knowledge moderated the effect of engagement on information recall. In the context of news reports on health, participants with worse arithmetic skills were more likely to rely on exemplars than "impersonal quantitative specifications," which in turn affected empathic perceptions of hardship and policy attitudes (Gibson et al., 2011, p. 114). When integrating individual narratives into maps, it may be the case that certain participants pay more attention to the individual narrative. As a result, the effect of exemplification on all the outcomes may be moderated by chart literacy (**H4a)** or chart confidence (**H4b)**.

Methods

Experimental conditions

To assess how exemplification affected attitudes, we created three different information displays for three social determinants of health (nine stimuli in total). All information was focused on the UK, for a few reasons. It faces stark and growing health inequalities and the survey platform we used – Prolific – only offers representative samples of the UK and the US. A large proportion of health inequalities research is conducted in the UK (Collyer & Smith, 2020), so the results of this study will be directly relevant to those researchers wishing to communicate their work. Also, the UK has a depth of research on lay perspectives toward the social determinants of health (Bernard et al., 2024), which can be used to complement or contextualize our findings.

Topic selection

We tested maps on three different social determinants. In a study of political rhetoric more broadly, Blumenau and Lauderdale (2024) assessed argument types across 12 different policy issues in the UK, and the persuasiveness of different types varied depending on the issue. The public already thinks differently about different determinants (L'Hôte et al., 2022), so we considered multiple determinants to improve external validity.

We carefully considered which social determinants of health to visualize on thematic maps, and with what measures. The Health Foundation categorizes the social determinants by six broad themes (The Health Foundation, n.d.), and to improve the generalizability of the results, each of our three topics came from a different one of these themes. The social determinants affect health through a range of mechanisms (Marmot et al., 2020), and in line with the advice in L'Hôte et al. (2022), we kept the number of mechanisms discussed for each

determinant to a minimum. The first topic was public transport, with the mechanism as employment opportunities and chronic stress (stimuli shown in the Graphical Abstract). The second topic was air pollution, which impacts health directly (stimuli shown in Figure 1, with accompanying text in Section A of the Appendix). The third topic was youth service provision, with the mechanism as community cohesion and mental health.

Adding exemplification

For each topic, participants were presented with a short textual explanation of how that social determinant affects

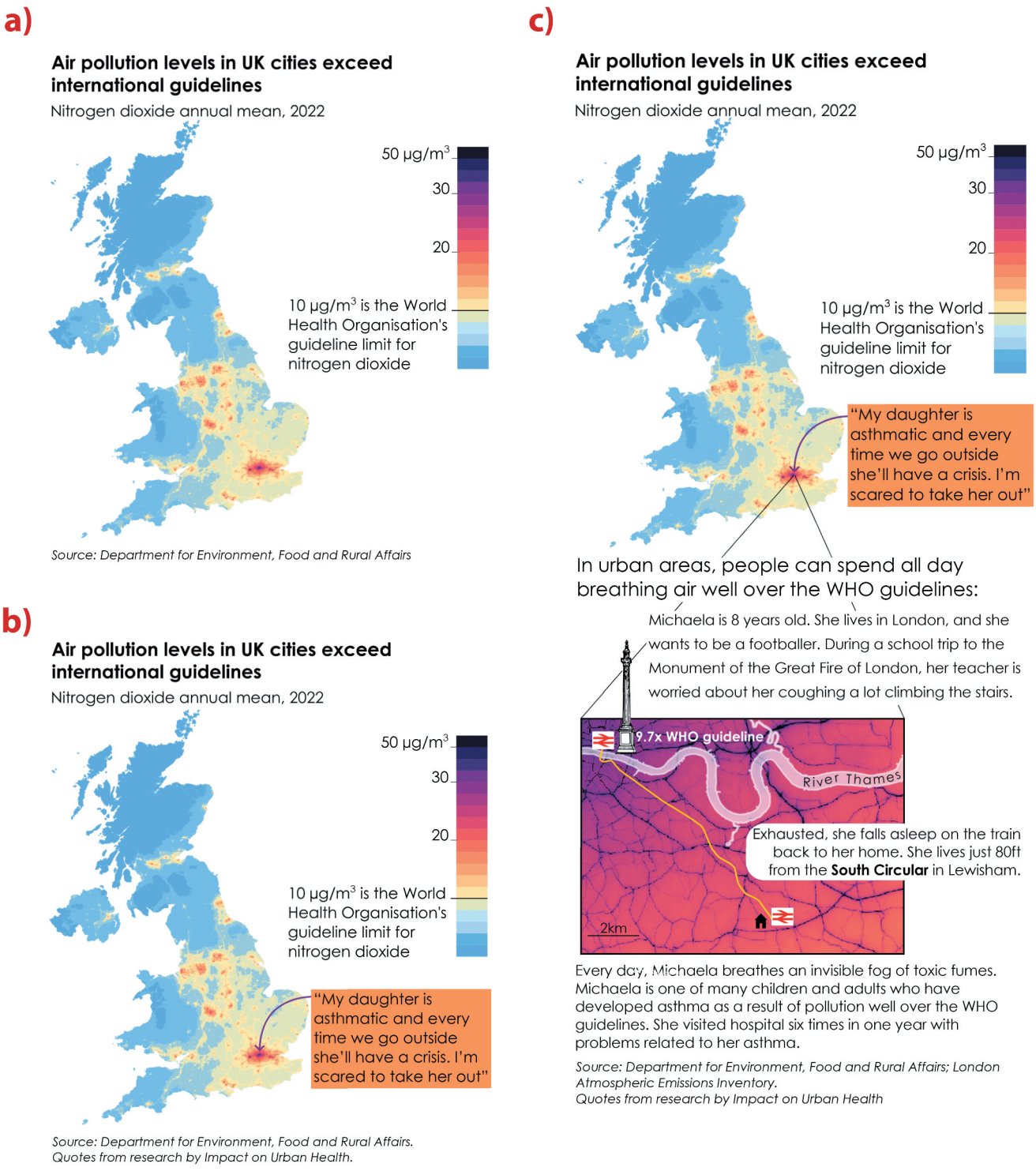


Figure 1. Maps for the air pollution topic. a) is "community," b) is "quotes," and c) is "individual." All three were presented alongside the same additional accompanying text on the link to health inequalities.

health and health inequalities, including a key statistic. They were then shown one of three graphics, which varied by level of exemplification. First, the "community" condition was a choropleth map showing a variable at the local authority level (average population size 190,000). The maps included titles to explain the key takeaway, as well as accessible color palettes, and data sources.

Second, the "quotes" condition provided the same quantitative data as the "community" condition but added arrows to certain areas with quotations attributed to individuals who live in those areas. These were genuine quotes from various reports by public health advocates (Booth, 2024; Crisp et al., 2018; Impact on Urban Health, 2020), and their sources were added as references. The individuals were usually named, and quotes were chosen to help illustrate the mechanism to health explained in the textual information.

Third, the "individual" condition showed everything in the previous two conditions but with an inset "zooming in" on an individual's experience (or two individuals in the case of youth service provision). These insets revealed new data. For public transport, these were isochrones from where fictional character "Josh" lived, demonstrating how poor public transport was detrimental to employment opportunities especially for those without a car. For air pollution, it was a more granular version of the data in the main map with locations that "Michaela" visited, as well as annotations of how far over the WHO NO_2 guidelines these places were. Her story, including the locations she visited, was adapted from part of Mayor of London Sadiq Khan's (2023) book on air pollution concerning Ella Kissi-Debrah. Our version did not mention her death, so as not to make one "individual" condition substantially more affective. For youth service provision, it showed specific youth centers that had closed between 2011 and 2021 in the London borough of Sutton, as well as fictional home locations for "Nicole" and "Alex." The three stimuli for this topic are shown in Figure 2.

By providing more details on a character's life via written annotation, as well as granular data focusing on their area, the "individual" maps may be more emotionally interesting, imagery-provoking, or spatially proximate than the "quotes" maps and therefore, according to Nisbett and Ross (1980), more vivid. The use of quotation satisfies Roth's (2021) "voice" trope in cartographic design, while the change in map scale and further annotation fall into his "focalization" trope. He notes that the combination of these "produces a unique vantage point, which, for spatial narratives, shifts the map scale and projection from a planimetric, north-up view to be grounded from 'somewhere' and 'someone'" (Roth, 2021, p. 105). As a result, we argue that this condition goes much further in showcasing an individual story and therefore a greater level of exemplification.

At the beginning of the survey, participants were informed that any quotes were real but that location details were fictional for privacy reasons. The aim here was to portray the provenance of the quotes while at the same time showing maps that might be created by advocates who are not willing to disclose people's genuine home locations.

We made a concerted effort to ensure differences between our graphics were restricted to differences in exemplification. Any relevant statistics were presented in all conditions – for example, the fact that 37% of the poorest households in the UK do not own a car was shown in all public transport conditions but explicitly linked to the character of "Josh" in the "quotes" and "individual" conditions. We did not present stimuli of the person-centered maps without the community-level maps, to isolate the effect of increasing exemplification rather than removing abstract information. And while the maps were produced by the first author rather than a professional cartographer, we prioritized visual consistency across conditions. All graphics were sized to display clearly on a mobile device, and the design choices (e.g. number of categories) were held constant to isolate the variable of interest.

Participants

We recruited 400 participants through Prolific. They were pre-screened to only include adults who live in the UK. Participants formed a representative sample of the UK public by age, gender, and political party affiliation. They were paid £2.30 in line with Prolific's recommendations, and the median completion time was just under 16 min. After removing participants who failed attention checks, 389 responses remained for analysis. A breakdown of participant demographics, including their region, can be found in Section D of the Appendix.

Procedure

Participants were redirected from Prolific to the survey on Qualtrics and provided with an informed consent form. They were then shown some textual background information on the extent of geographical health inequalities in the UK. This also included an introduction to what the social determinants of health are, presented as "building blocks," and this text was largely adapted from recommendations in L'Hôte et al. (2022).

Participants then proceeded to the main experiment, shown in blue in Figure 3. Starting with the

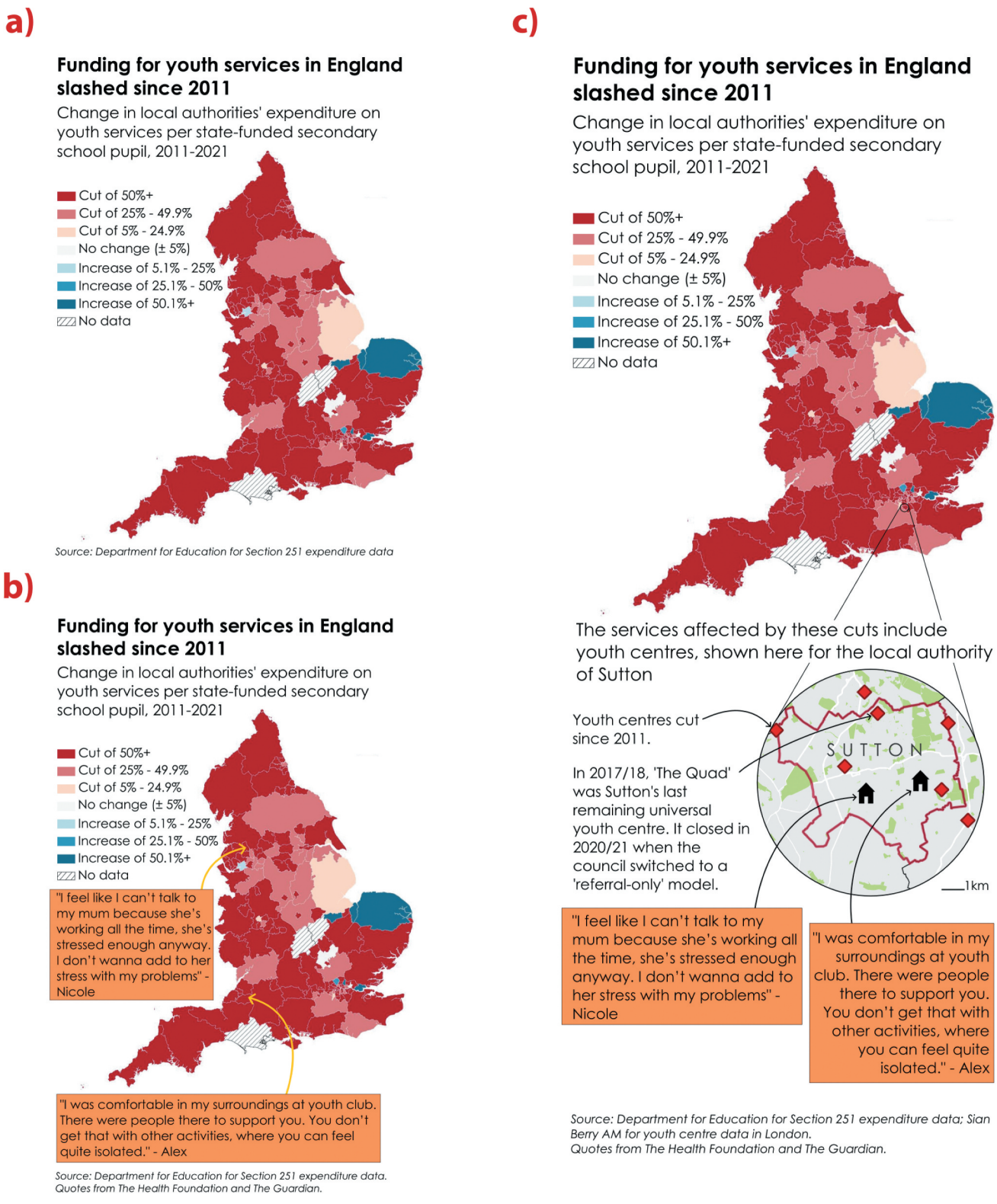


Figure 2. Maps for the youth services topic. a) is "community," b) is "quotes," and c) is "individual." All three were presented alongside the same text on the link between youth services and health inequalities.

public transport topic, they were randomly presented with one of the three conditions described above ("community," "quotes," or "individual"). Then they were asked for their attitudes on the information and the topic more broadly. These steps were repeated for the air pollution topic, and then the youth service provision topic. The randomizers for each topic are independent.

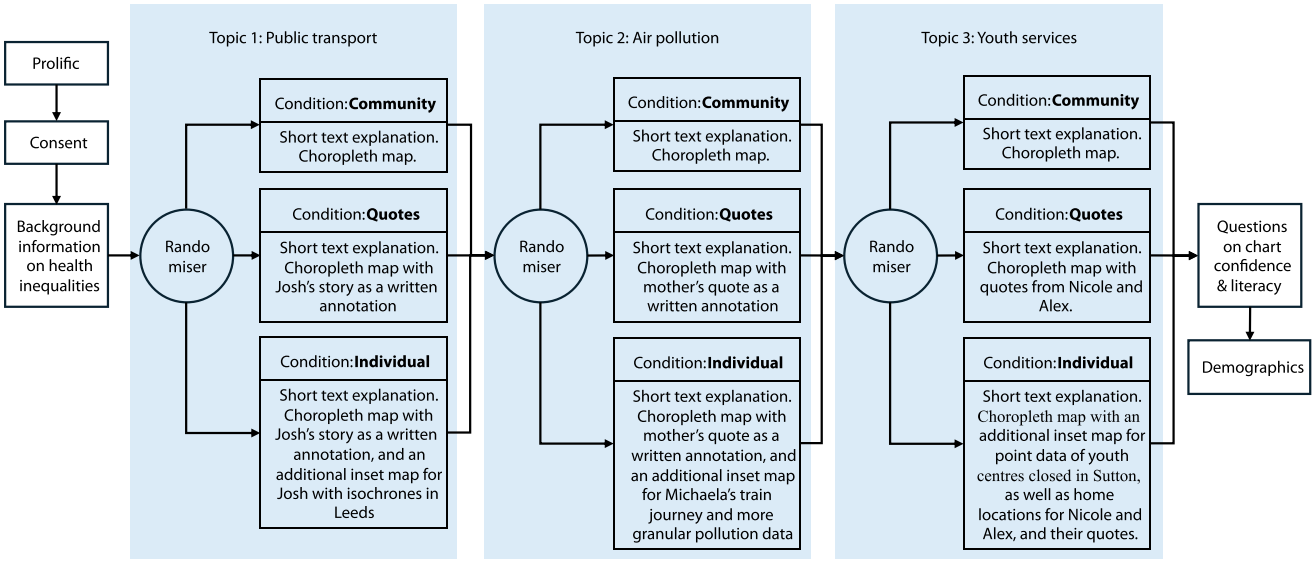


Figure 3. Experimental procedure.

Finally, participants were asked questions on chart confidence, chart literacy, and demographics. They were told that the study was designed to test the influence of different maps on attitudes toward the social determinants of health. Then participants were redirected to Prolific for payment.

Measures

Participants saw a similar set of questions for each topic, outlined below. Besides the open-ended response questions, all measures were on a seven-point Likert scale.

Dependent variable

The main measure of persuasion, *policy priority*, asked participants how much they agreed that improvements to the given topic should be a priority for national and local governments. To encourage disagreement, they were told this may involve raising taxes (or, in the case of air pollution, restrictions on motorists). Participants were not asked for attitudes on specific policies since the purpose of the maps was to explain the role of the social determinants rather than advocate for specific solutions.

Mediating variables

Issue severity was measured by asking how much participants agreed that the topic is a serious national problem, a question adapted from Gibson and Zillmann (1994, as cited in Oh et al., 2018). We measured *link to health inequalities* by asking whether improvements in that social determinant would contribute to a reduction in UK health inequalities. *Engagement* was measured with two questions, asking how much they thought the information they saw was engaging, and whether they thought it was boring (which was reverse coded). We gauged attitudes toward credibility by asking whether they thought the information was *manipulative/exaggerated* (asked separately; we present the average), as well as if it was *trustworthy*.

Control variables

We controlled for age, gender, education, and political party affiliation, although the randomization ensured a good balance of these characteristics between treatment groups (see Section C of the Appendix for balance tables). We controlled for political party affiliation because of a US study in which Republicans and Democrats had markedly different responses to social determinant messaging (Gollust et al., 2009).

Open-ended response

After seeing each piece of information, the first question was to briefly describe what they thought and how they felt about the issue. This was optional, although 98% of participants provided an answer for every topic, with a median word count of 28 words per topic. We asked this before the Likert-style questions so as not to prime respondents to think about those questions (for the first topic at least).

Dual experimental design: between-subject and within-subject

Part of the analysis focused on each topic separately, comparing responses between treatment groups. An

additional piece of analysis focused on responses within-subjects but between topics. That is, did users' responses vary depending on the combination of treatments they saw across the topics? If a user saw the "community" condition for public transport but the "individual" condition for air pollution, were they likely to respond differently to the second topic, compared to someone who saw "community" for both topics? The independent variable associated with this – *change in exemplification* – was derived using Table 2. For parsimony, we treated exemplification as a numeric ordinal concept, with equal difference between "community," "quotes," and "individual" conditions. Approximately one-ninth of respondents should have a *change in exemplification* score of + 2 ("community" followed by "individual"), while one-third will have a score of 0 (the same level of exemplification twice in a row). A score for the change from topic 2 (air pollution) to topic 3 (youth services) was derived with the same method. We made no direct comparison between topic 1 and topic 3.

The within-subjects analysis compares respondents' attitudes between topics. To account for population-level differences in attitudes to the three topics, scores were centered on the mean for each topic. For example, the change in *policy priority* score for the first two topics, for any given user, was calculated with the following equation:

$$\Delta priority_{1\rightarrow 2,i} = \left(P_{i,2} - \bar{P}_2\right) - \left(P_{i,1} - \bar{P}_1\right)$$

where $P_{i,1}$ and $P_{i,2}$ represent individual i's agreement that the issue should be a policy priority, for topic 1 (public transport) and topic 2 (air pollution) respectively. $\bar{P}_1$ and $\bar{P}_2$ are the mean *policy priority* scores for those topics across the full sample of those topics. Differences in attitudes were calculated in this way for all mediator variables.

Table 2. The change in exemplification score associated with each combination of maps for topic 1 (public transport) and topic 2 (air pollution).

Transport	Pollution	Change in exemplification
Community	Quotes	+1
Community	Individual	+2
Quotes	Individual	+1
Individual	Quotes	−1
Individual	Community	−2
Quotes	Community	−1
Individual	Individual	0
Quotes	Quotes	0
Community	Community	0

Results

Between-subject analysis

The between-subject analysis found little support for the effect of exemplification on any of the assessed attitudes. Table 3 shows the result of a series of bootstrapped linear regression models (10,000 resamples each) on the six outcome measures across all three topics. This found no significant results, including no interactions with chart confidence.

Within-subject analysis

The within-subject analysis, however, suggested that exemplification did influence the mediators and persuasion when looking at how users responded differently to the first two topics, at least when moderating by chart confidence. Figure 4 shows path diagrams of two structural equation models, with one comparing responses to the first two topics, and another comparing responses to topics two and three.

The within-subject analysis provides some support to hypotheses **H1** and **H2**, with an increase in exemplification between the first and second topics predicting a significant increase in *policy priority* (persuasion) moderated by an increase of 0.60 in *perceived severity*, 0.87 in *link to health inequalities*, and 0.58 in *engagement*, but only for those with lower chart confidence (supporting **H4b**). There was no interaction with chart literacy, so we can reject the hypothesis **H4a**. This model also provides partial support for **H3**, on credibility, since exemplification did not prompt more defensive responses, and, surprisingly, was deemed more trustworthy by those with lower chart confidence. These patterns were not replicated when comparing responses to the second and third topics (in the bottom half of Figure 4).

Binning chart confidence into two groups (higher and lower than average) allows us to visualize what those significant effects mean more easily. Figure 5 shows the predicted difference in user responses to the *policy priority* question between the first two topics, based on the regression model (with 10,000 bootstrap replicates).

Among users with low chart confidence, those presented with the "community" condition for the public transport topic and then the "individual" condition for the air pollution topic (i.e. *change in exemplification* score of +2) are estimated to view air pollution as more of a priority issue for government, with their change in agreement score 0.73 points higher than those who see the same condition for both (i.e. *change in exemplification* score of 0) ($p < 0.01$). The same visualization can be seen in Section E of the Appendix, regressing on the five mediators instead of *policy priority*.

Table 3. Linear regression results for the extent of exemplification (community, quotes, or individual) on the six outcome variables for each of the three topics, moderated by chart confidence. Ten thousand bootstrap resamples.

	Priority			Severity			Link			Trust			Engagement			Manipulative/Exaggerated		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Constant	−1.87	−0.96	−1.51	−1.08	−0.31	−1.61	−1.16	−0.44	−0.54	−2.08	−1.84	−2.48	−1.71	−0.54	−0.63	0.63	1.17	0.62
	(0.71)**	(0.67)	(0.73)*	(0.62)	(0.61)	(0.78)*	(0.63)	(0.63)	(0.65)	(0.74)**	(0.86)*	(0.79)**	(0.67)*	(0.28)	(0.26)*	(0.55)	(0.68)	(0.65)
Quotes	1.09	0.75	0.26	0.71	0.69	0.67	0.78	0.52	0.07	0.31	0.54	0.15	−0.11	0.18	0.43	0.29	−0.48	−0.22
	(0.89)	(0.74)	(1.02)	(0.66)	(0.74)	(1.03)	(0.78)	(0.78)	(0.88)	(0.89)	(1.00)	(0.99)	(0.98)	(0.33)	(0.32)	(0.65)	(0.82)	(0.81)
Individual	0.73	0.05	0.15	0.39	−0.27	0.70	0.79	−0.42	−0.60	1.19	0.34	1.09	1.01	0.11	0.32	−0.51	−0.57	−0.37
	(0.87)	(0.76)	(0.92)	(0.69)	(0.74)	(0.94)	(0.75)	(0.90)	(0.88)	(0.90)	(1.07)	(0.93)	(0.74)	(0.39)	(0.32)	(0.66)	(0.84)	(0.81)
Quotes × Chart confidence	−0.17	−0.12	−0.05	−0.11	−0.11	−0.11	−0.09	−0.08	−0.01	−0.03	−0.10	−0.03	0.01	−0.04	−0.07	−0.03	0.10	0.07
	(0.14)	(0.12)	(0.16)	(0.10)	(0.12)	(0.16)	(0.12)	(0.13)	(0.14)	(0.14)	(0.16)	(0.16)	(0.16)	(0.05)	(0.05)	(0.11)	(0.13)	(0.12)
Individual × Chart confidence	−0.10	0.02	−0.02	−0.06	0.06	−0.10	−0.12	0.09	0.08	−0.18	−0.07	−0.19	−0.15	−0.02	−0.04	0.12	0.16	0.11
	(0.14)	(0.12)	(0.15)	(0.10)	(0.12)	(0.15)	(0.12)	(0.15)	(0.14)	(0.14)	(0.17)	(0.15)	(0.12)	(0.06)	(0.05)	(0.11)	(0.14)	(0.13)
R^2	0.08	0.12	0.07	0.06	0.10	0.07	0.05	0.07	0.06	0.06	0.06	0.10	0.07	0.05	0.07	0.05	0.08	0.07

(1) Public transport, (2) Air pollution, (3) Youth services.
Quotes and Individual are both compared to the reference category of Community.
Covariates are age, gender, education, and political party affiliation.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Open-ended responses

Across all nine maps, the vast majority of open-ended responses were in line with the information's intended message. Several responses suggested that the information was new or illuminating:

> It is a concern and an issue I was not aware of. (Public transport, quotes)

> I'd never thought about it before, but it's obvious, isn't it? (Public transport, *individual*)

> Air pollution around the UKs biggest cities is substantial, and I did not know it was that stark of a comparison in relation to rural areas. (Air pollution, community)

By contrast, a minority were unconvinced that these were priority issues, especially the third topic on youth service provision:

> I think that air pollution does play a part, however people can make choices about where to live and work? (Air pollution, quotes)

> I think there are more pressing issues right now and children could organise something themselves. (Youth services, quotes)

A subset of those who were skeptical about the importance of the issue expressed a desire to see more data linking the social determinant with health, unsatisfied by the statistics in the supporting text.

> Reports of cuts to youth services- if true, this is alarming but I would like to see hard data on the correlation of these services and reductions I [sic] eg knife crime (Youth service provision, individual)

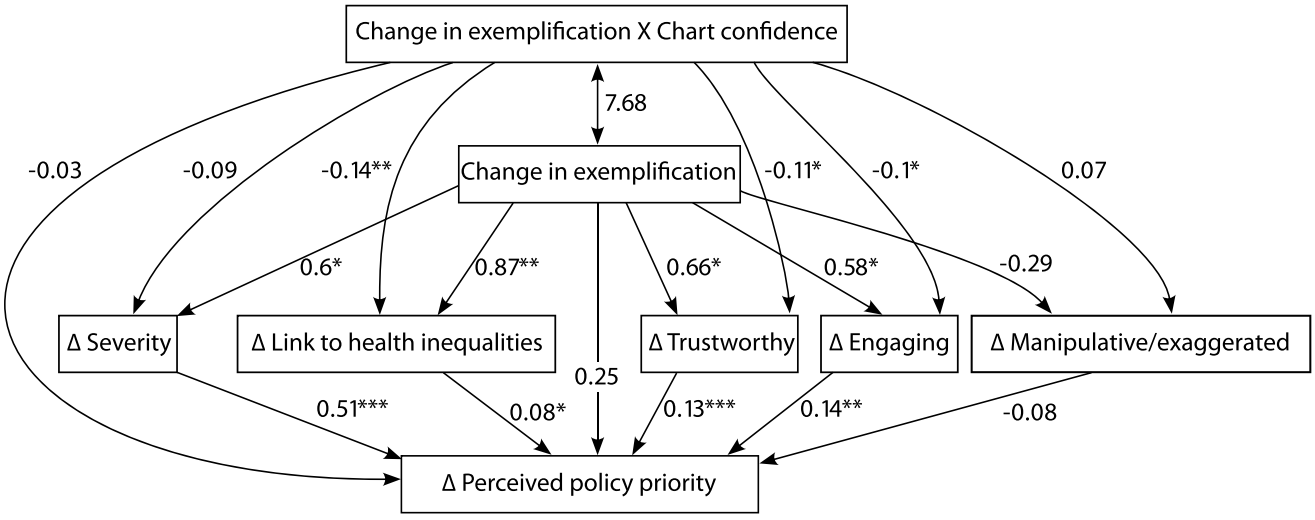
> No evidence to suggest funding for youth clubs is money well-spent (Youth service provision, community)

We found few substantial differences in the open-ended responses between treatment groups. Further analysis of the open-ended responses can be found in Section G of the Appendix.

Discussion

This survey experiment aimed to understand if adding examples of individuals to maps about the social determinants of health would be persuasive, via greater engagement and comprehension, or whether it would backfire due to a perception of bias. Our results show that there were few differences in user perceptions by the level of exemplification presented to them, except when examining within-subjects for the first two topics and interacting with chart confidence. In this section, we discuss implications and attempt to consolidate the differing results of the dual experimental designs. We

Change: topic 1 (public transport) to topic 2 (air pollution)



Change: topic 2 (air pollution) to topic 3 (youth services)

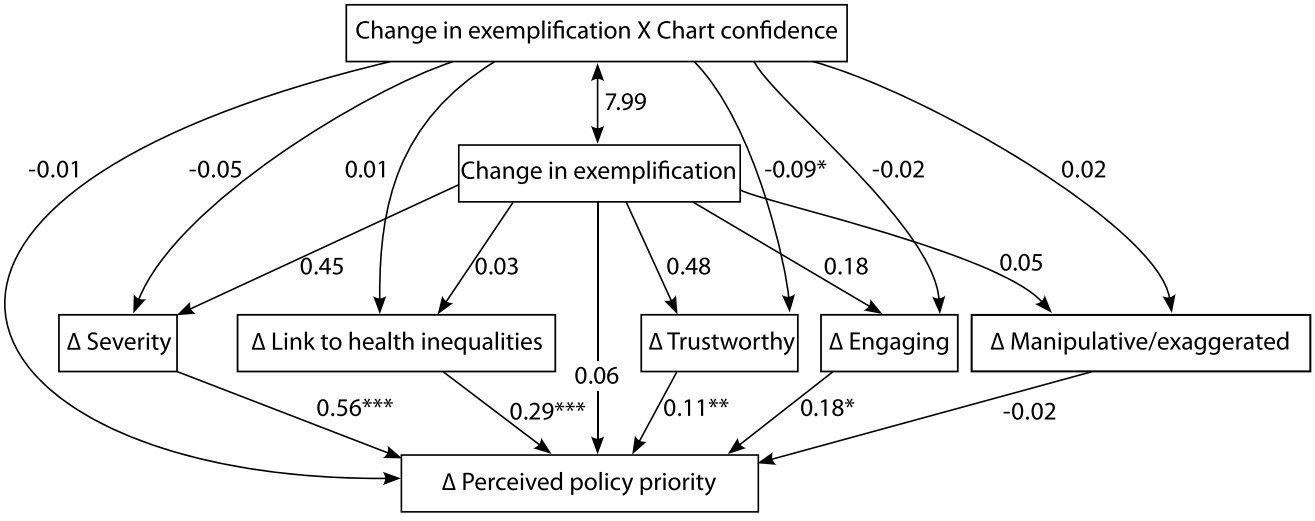


Figure 4. Structural equation models with path coefficients. This model uses continuous chart confidence (from 1 to 7). Top: all variables refer to the difference (Δ) between centered scores for the first two topics. Bottom: all variables refer to the difference between centered scores for the second and third topics.*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

also discuss the importance of attitudes varying by chart confidence, and the limitations of our study.

This study is the latest in a series of survey experiments in which varying specific elements of data visualizations has had little effect on user attitudes. Boy et al. (2017) found that various depictions of data on human rights issues in Syria did not lead to more empathy or prosocial behavior than, for example, a pie chart. In the context of immigration, Liem et al. (2020) found that different approaches to building narratives with data visualization – such as personal narratives and structured stories – had a much smaller effect on attitude than discourse on data storytelling suggests. Aune and Hompland (2024) varied palette, shapes, and the stance of visualizations about nuclear power, but found no significant impact on attitudes.

One explanation for the lack of results in the between-subject analysis is that people's attitudes toward the social determinants of health are strongly held and therefore not likely to be swayed by one page of information. A related explanation is that, without the nuances of specific policy proposals, the public are already in consensus on the severity of the issues and their relationship to health inequalities. Indeed, scores

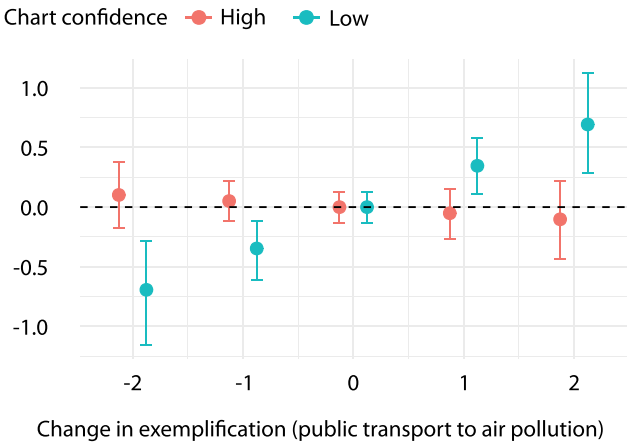


Figure 5. Predicted change in centered *policy priority* attitudes between the public transport and air pollution topics, with 95% BCa confidence intervals.

for each of the questions on attitudes were at one end of the scale (72% of participants at least "somewhat agree" that all the topics were a policy priority), so maps designed to persuade in that direction had little room to travel.

That said, while research shows that lay perspectives on the role of social determinants are broadly aligned with expert understandings (Bernard et al., 2024; Smith & Anderson, 2018), other studies show that attitudes on the social determinants are pliable to different message frames (L'Hôte et al., 2022). Bernard et al. (2024, p. 6) suggest that "framing discussions around health inequalities regionally, rather than locally, encourages upstream narratives," and it may be that the presentation of a national map to all participants shaped responses accordingly.

Another strategy would have been to refine the questions such that participants were even less likely to agree with them. We might have achieved this by providing more detail on the trade-offs regarding taxes or restrictions for motorists. An alternative would be to use pairwise comparisons to assess policy preferences or relative issue salience.

Why did the within-subjects study design suggest exemplification had some persuasive effect, at least for those with lower-than-average confidence using charts and statistical maps? It is not necessarily that one particular map condition for either the public transport or air pollution topics was anomalously (un)persuasive and therefore skewing the results, because the effect was evident whether you went from a map with low exemplification to high exemplification or vice versa.

Instead, we speculate that there was a priming effect, and participants were in effect comparing their attitudes to the second topic to their attitudes to the first. Users may have had a heightened awareness of differences between maps, and so the impact of exemplification in real-world situations might be overstated by this analysis. We saw no significant effect when comparing topics 2 and 3, which might indicate a weakened or short-lived priming effect. The open-ended responses suggest topic 3 was less convincing in general, so perhaps this determinant required clearer explanation regardless of exemplification. Randomizing the order of topics would have strengthened these within-subjects results.

It is difficult to tell whether the shift in relative attitudes was caused by the addition (or removal) of a person-centered data-driven example, or simply by presenting more (or less) information. The results show that those with lower chart confidence were more persuaded by the conditions with greater exemplification. These conditions provided more information by design, and these differences were reflected in completion times. The more "individual" conditions a participant was presented with, the more time they spent on the survey.

Even if it is simply the extra information, rather than exemplification specifically that is driving the change, this does not mean exemplification was ineffective. Exemplification was a useful tool to show more information, which may have influenced attitudes through greater engagement or by making more explicit the implications of aggregate data on real individuals (the largest effect size was on the *Link to health inequalities*).

The interaction with chart confidence aligns directionally with other studies' findings on chart literacy, interest, and motivation (Cummins & Hahn, 2022; Gibson et al., 2011). According to the Elaboration Likelihood Model, people process information through one of two routes: the central route, deliberating content, or the peripheral route, relying on cues or heuristics (Petty & Cacioppo, 1986). Some participants are more likely to rely on peripheral cues such as attractiveness or the number of arguments to process an argument's quality and therefore be persuaded (Lam et al., 2022). Participants might be more likely to take the peripheral route if they find the information personally relevant, are knowledgeable on the topic, or – most pertinent to our study – are able to evaluate the message without difficulty.

Those less confident using charts and statistical maps may be more likely to look to peripheral cues, quickly perceive that the map has more information or is more attractive in comparison to the previous topic, and change their attitude accordingly. In this model, chart confidence could be a more relevant concept than chart literacy, because if you are chart literate but not confident, you might dismiss your ability, make a quick judgment, and move on. The maps in this study are quite simple, and information with two variables or more might see

a more pronounced effect. The results of our study suggest there may be value in measuring user confidence alongside measures such as chart literacy and warrant further analysis into what drives these differences.

There are several avenues for future research here. One extension of this study would be to test exemplification within maps or charts with more than one variable, since the social determinants refer, by definition, to causality. One study found scatterplots of the issue faced accusations of oversimplification, and when a focus group participant was presented with a map of obesity alongside a map of violence rates, they did not move beyond the apparent message that "overweight people are more likely to shoot people" (Lundell et al., 2013, p. 494). Accusations of oversimplified charts worsen perceived credibility (Parrott et al., 2005) and has been an acute problem in this highly political topic (Pickett & Wilkinson, 2015). The desire for such analyses was reflected in some of the open-ended responses.

A range of other modifications could be made to the study. Firstly, the maps could be presented in a more specific context, for example as academic papers, news reports, social media posts, or policy documents. Secondly, the conditions could have varied more dramatically. In an attempt to isolate the impact of one aspect – exemplification – we changed relatively little between conditions. The explanatory text and the main map at the national level were consistent, and these still accounted for a substantial proportion of the information presented even in the "individual" condition maps. Other studies could be bolder in removing or shortening this information.

Third, static maps may not be the most effective medium in which to integrate specific examples. Indeed, the examples that we presented from data journalism are interactive maps. Interactivity can make information on social issues more engaging and persuasive (Jia & Sundar, 2023), and may be especially engaging when users can explore data relevant to their own communities. The effects of adding exemplification to interactive maps may be interesting. Fourth, the work could be extended to test the reactions of a policy audience. Finally, it could be valuable to assess responses to maps which showcased the effect of policy solutions, which is a recommended focus for communicators (L'Hôte et al., 2022).

While there is a minimal effect on persuasion, this study also suggests that there is little harm in integrating individual narratives within maps of aggregated data. Since there is some evidence that it helps at least those with the least confidence in using charts and statistical maps, cartographers may do well to experiment with this further.

Conclusion

This study drew on exemplification theory to examine whether integrating individual narratives within maps of aggregated data affects engagement, comprehension, defensive responses, or persuasion. Analysis between-subjects found minimal results while looking within-subjects found that exemplification had some persuasive effects for those with lower-than-average chart confidence. This contributes to our understanding of communicating on the social determinants and similarly complex issues like climate change, and it calls for further investigation into the role of chart confidence in persuasion.

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Data availability statement

The data that support the findings of this study are openly available in figshare at https://doi.org/10.5522/04/28608185.v1

Ethical approval

Ethical approval was granted by the UCL SHS Local Research Ethics Committee, with approval number SHSGeo-2324-138-1.

References

Abdalla, S. M., Hernandez, M., Fazaludeen Koya, S., Rosenberg, S. B., Robbins, G., Magana, L., Nsoesie, E. O., Sabin, L., & Galea, S. (2022). What matters for health? Public views from eight countries. *BMJ Global Health*, *7* (6), e008858. https://doi.org/10.1136/bmjgh-2022-008858

Aune, S. U., & Hompland, K. (2024). *Designing for attitudes: Testing affective design in persuasive data visualizations*

[Master thesis]. NTNU. https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/3154948

Baum, F., & Fisher, M. (2014). Why behavioural health promotion endures despite its failure to reduce health inequities. *Sociology of Health and Illness*, *36*(2), 213–225. https://doi.org/10.1111/1467-9566.12112

Bergan, D., & Lee, H. (2019). Media credibility and the base rate fallacy. *Journal of Broadcasting and Electronic Media*, *63*(2), 195–210. https://doi.org/10.1080/08838151.2019.1620563

Bernard, K., McGowan, V. J., & Bambra, C. (2024). "Power, control, strain": Lay perceptions of health inequalities across england's 'north south divide'. *Social Science and Medicine*, *355*, 117089. https://doi.org/10.1016/j.socscimed.2024.117089

Blumenau, J., & Lauderdale, B. E. (2024). The variable persuasiveness of political rhetoric. *American Journal of Political Science*, *68*(1), 255–270. https://doi.org/10.1111/ajps.12703

Booth, R. (2024, June 30). Teenagers 'crying out' for return of youth clubs in England, study finds. *The Guardian*. https://www.theguardian.com/society/article/2024/jun/30/teenagers-crying-out-for-return-of-youth-clubs-in-england-study-finds

Boy, J., Pandey, A. V., Emerson, J., Satterthwaite, M., Nov, O., & Bertini, E. (2017). Showing people behind data: Does anthropomorphizing visualizations elicit more empathy for human rights data? In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (pp. 5462–5474). Association for Computing Machinery. https://doi.org/10.1145/3025453.3025512

Cheshire, J. (2012). Lives on the line: Mapping life expectancy along the London tube network. *Environment & Planning A: Economy & Space*, *44*(7), 1525–1528. https://doi.org/10.1068/a45341

Cheshire, J., & Uberti, O. (2021). *Atlas of the invisible*. https://www.penguin.co.uk/books/307265/atlas-of-the-invisible-by-uberti-james-cheshire-and-oliver/9781846149719

Collyer, T. A., & Smith, K. E. (2020). An atlas of health inequalities and health disparities research: "How is this all getting done in silos, and why?" *Social Science and Medicine*, *264*, 113330. https://doi.org/10.1016/j.socscimed.2020.113330

Crisp, R., Ferrari, E., Gore, T., Green, S., McCarthy, L., Rae, A., Reeve, K., & Stevens, M. (2018). *Tackling transport-related barriers to employment in low-income neighbourhoods*. Joseph Rowntree Foundation. https://www.shu.ac.uk/centre-regional-economic-social-research/publications/tackling-transport-related-barriers-to-employment-in-low-income-neighbourhoods

Cummins, R. G., & Hahn, D. (2022). Selective exposure and exemplification within sports highlights. *Journal of Broadcasting and Electronic Media*, *66*(1), 22–46. https://doi.org/10.1080/08838151.2021.2008938

D'Ignazio, C., & Klein, L. F. (2020). *Data feminism*. MIT Libraries Experimental Collections Fund. https://doi.org/10.7551/mitpress/11805.001.0001

Esri. (n.d.). *ArcGIS StoryMaps project gallery*. Retrieved January 17, 2025, from https://doc.arcgis.com/en/arcgis-storymaps/gallery/

Fish, C. S. (2021). Elements of vivid cartography. *The Cartographic Journal*, *58*(2), 150–166. https://doi.org/10.1080/00087041.2020.1800160

Fish, C. S., & Kreitzberg, K. Q. (2023). Mapping in an echo chamber: How cartographic silence frames conservative media's climate change denial. *Annals of the American Association of Geographers*, *113*(10), 2480–2496. https://doi.org/10.1080/24694452.2023.2227672

Fragapane, F. (2018, November 29). The stories behind a line: How-and why-I designed a visual narrative of six asylum seekers' routes. *Medium*. https://medium.com/@federicafragapane/the-stories-behind-a-line-73a1bb247978

Gibson, R., Callison, C., & Zillmann, D. (2011). Quantitative literacy and affective reactivity in processing statistical information and case histories in the news. *Media Psychology*, *14*(1), 96–120. https://doi.org/10.1080/15213269.2010.547830

Gibson, R., & Zillmann, D. (1994). Exaggerated versus representative exemplification in news reports: Perception of issues and personal consequences. *Communication Research*, *21*(5), 603–624. https://doi.org/10.1177/009365094021005003

Gollust, S. E., Lantz, P. M., & Ubel, P. A. (2009). The polarizing effect of news media messages about the social determinants of health. *American Journal of Public Health*, *99*(12), 2160–2167. https://doi.org/10.2105/AJPH.2009.161414

Harris, J. (2015, January 15). Connecting with the dots. *Source*. https://source.opennews.org/articles/connecting-dots/

The Health Foundation. (n.d.). *Evidence hub: What drives health inequalities? - The Health Foundation*. Retrieved January 17, 2025, from https://www.health.org.uk/evidence-hub

Hoeken, H., & Hustinx, L. (2009). When is statistical evidence superior to anecdotal evidence in supporting probability claims? The role of argument type. *Human Communication Research*, *35*(4), 491–510. https://doi.org/10.1111/j.1468-2958.2009.01360.x

Impact on Urban Health. (2020). *Tackling air pollution in inner cities - What the evidence says and what people think*. https://urbanhealth.org.uk/insights/reports/tackling-air-pollution-in-inner-cities-what-the-evidence-says-and-what-people-think

Iyengar, S. (1991). *Is anyone responsible?: How television frames political issues/Shanto Iyengar*. University of Chicago Press.

Jia, H., & Sundar, S. S. (2023). Vivid and engaging: Effects of interactive data visualization on perceptions and attitudes about social issues. *Digital Journalism*, 1–25. https://doi.org/10.1080/21670811.2023.2250815

Kaysen, R., & Singer, E. (2024, October 31). Millions of movers reveal American polarization in action. *The New York Times*. https://www.nytimes.com/interactive/2024/10/30/upshot/voters-moving-polarization.html

Kelly, M. (2023). The gallery of possibilities. *Professional Geographer*, *75*(4), 663–675. https://doi.org/10.1080/00330124.2023.2169174

Kennedy, H., Hill, R. L., Aiello, G., & Allen, W. (2016). The work that visualisation conventions do. *Information Communication & Society*, *19*(6), 715–735. https://doi.org/10.1080/1369118X.2016.1153126

Khan, S. (2023). *Breathe: Tacking the climate emergency*. Hutchinson Heinemann.

Knigge, L., & Cope, M. (2006). Grounded visualization: Integrating the analysis of qualitative and quantitative data through grounded theory and visualization. *Environment & Planning A*, *38*(11), 2021–2037. https://doi.org/10.1068/a37327

Kolak, M., Bhatt, J., Park, Y. H., Padrón, N. A., & Molefe, A. (2020). Quantification of neighborhood-level social determinants of health in the continental United States. *JAMA Network Open*, *3*(1), e1919928. https://doi.org/10.1001/jamanetworkopen.2019.19928

Kong, H.-K., Liu, Z., & Karahalios, K. (2018). Frames and slants in titles of visualizations on controversial topics. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (pp. 1–12). Association for Computing Machinery. https://doi.org/10.1145/3173574.3174012

Kwan, M.-P. (2002). Feminist visualization: Re-envisioning GIS as a method in feminist geographic research. *Annals of the Association of American Geographers*, *92*(4), 645–661. https://doi.org/10.1111/1467-8306.00309

Lam, C., Huang, Z., & Shen, L. (2022). Infographics and the elaboration likelihood model (ELM): Differences between visual and textual health messages. *Journal of Health Communication*, *27*(10), 737–745. https://doi.org/10.1080/10810730.2022.2157909

L'Hôte, E., Castellina, M., Volmert, A., Conklin, L., & O'Shea, P. (2022). *A matter of life and death: Explaining the wider determinants of health in the UK*. FrameWorks Insitute.

L'Hôte, E., Volmert, A., & Fond, M. (2018). *Seeing upstream: Mapping the gaps between expert and public understandings of health in the United Kingdom*. https://www.frameworksinstitute.org/publication/seeing-upstream-mapping-the-gaps-between-expert-and-public-understandings-of-health-in-the-united-kingdom/

Liem, J., Perin, C., & Wood, J. (2020). Structure and empathy in visual data storytelling: Evaluating their influence on attitude. *Computer Graphics Forum*, *39*(3), 277–289. https://doi.org/10.1111/cgf.13980

Lundell, H., Niederdeppe, J., & Clarke, C. (2013b). Public views about health causation, attributions of responsibility, and inequality. *Journal of Health Communication*, *18*(9), 1116–1130. https://doi.org/10.1080/10810730.2013.768724

Lundell, H., Niederdeppe, J., & Clarke, C. E. (2013a). Exploring interpretation of complexity and typicality in narratives and statistical images about the social determinants of health. *Health Communication*, *28*(5), 486–498. https://doi.org/10.1080/10410236.2012.699887

Macintyre, S., McKay, L., & Ellaway, A. (2005). Are rich people or poor people more likely to be ill? Lay perceptions, by social class and neighbourhood, of inequalities in health. *Social Science and Medicine*, *60*(2), 313–317. https://doi.org/10.1016/j.socscimed.2004.08.001

Mackenbach, J. P. (2011). Can we reduce health inequalities? An analysis of the English strategy (1997-2010). *Journal of Epidemiology and Community Health*, *65*(7), 568–575. https://doi.org/10.1136/jech.2010.128280

Marmot, M., Allen, J., Boyce, T., Goldblatt, P., & Morrison, J. (2020). *Marmot review 10 years on*. Institute of Health Equity. https://www.instituteofhealthequity.org/resources-reports/marmot-review-10-years-on

Marshall, L., & Allen, A. (2023). *Health and climate change: Complex problems with co-benefits*. The Health Foundation. https://www.health.org.uk/reports-and-analysis/briefings/health-and-climate-change-complex-problems-with-co-benefits

McKenna, S., Henry Riche, N., Lee, B., Boy, J., & Meyer, M. (2017). Visual narrative flow: Exploring factors shaping data visualization story reading experiences. *Computer Graphics Forum*, *36*(3), 377–387. https://doi.org/10.1111/cgf.13195

McMahon, N. E. (2022). Framing action to reduce health inequalities: What is argued for through use of the 'upstream-downstream' metaphor? *Journal of Public Health*, *44*(3), 671–678. https://doi.org/10.1093/pubmed/fdab157

Muehlenhaus, I. (2012). If looks could kill: The impact of different rhetorical styles on persuasive geocommunication. *The Cartographic Journal*, *49*(4), 361–375. https://doi.org/10.1179/1743277412Y.0000000032

Niederdeppe, J., Roh, S., & Dreisbach, C. (2016). How narrative focus and a statistical map shape health policy support among state legislators. *Health Communication*, *31*(2), 242–255. https://doi.org/10.1080/10410236.2014.998913

Nisbett, R. E., & Ross, L. (1980). *Human inference: Strategies and shortcomings of social judgment*. Prentice-Hall.

Nyhan, B., & Reifler, J. (2019). The roles of information deficits and identity threat in the prevalence of misperceptions. *Journal of Elections, Public Opinion and Parties*, *29*(2), 222–244. https://doi.org/10.1080/17457289.2018.1465061

Office for Health Improvement and Disparities. (n.d.). *Wider determinants of health*. Retrieved May 2, 2025, from https://fingertips.phe.org.uk/profile/wider-determinants

Oh, J., Lim, H. S., Copple, J. G., & Chadraba, E. K. (2018). Harnessing the persuasive potential of data: The combinatory effects of data visualization and interactive narratives on obesity perceptions and policy attitudes. *Telematics and Informatics*, *35*(6), 1755–1769. https://doi.org/10.1016/j.tele.2018.05.004

Parrott, R., Silk, K., Dorgan, K., Condit, C., & Harris, T. (2005). Risk comprehension and judgments of statistical evidentiary appeals: When a picture is not worth a thousand words. *Human Communication Research*, *31*(3), 423–452. https://doi.org/10.1111/j.1468-2958.2005.tb00878.x

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 19, pp. 123–205). Academic Press. https://doi.org/10.1016/S0065-2601(08)60214-2

Pickett, K., & Wilkinson, R. (2015). 20-the spirit level: A case study of the public dissemination of health inequalities research. In K. E. Smith, C. Bambra, & S. E. Hill (Eds.), *Health inequalities: Critical perspectives* (p. 0). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198703358.003.0020

Prestby, T. J. (2025). Trust in maps: What we know and what we need to know. *Cartography and Geographic Information Science*, *52*(1), 1–18. https://doi.org/10.1080/15230406.2023.2281306

Raphael, D., Bryant, T., Govender, P., Medvedyuk, S., & Mendly-Zambo, Z. (2022). Desperately seeking reductions

in health inequalities in Canada: Polemics and anger mobilization as the way forward? *Sociology of Health and Illness*, *44*(1), 130–146. https://doi.org/10.1111/1467-9566.13399

Riche, N. H., Hurter, C., Diakopoulos, N., & Carpendale, S. (Eds.). (2018). *Data-driven storytelling*. A K Peters/CRC Press. https://doi.org/10.1201/9781315281575

Roth, R. E. (2021). Cartographic design as visual storytelling: Synthesis and review of map-based narratives, genres, and tropes. *The Cartographic Journal*, *58*(1), 83–114. https://doi.org/10.1080/00087041.2019.1633103

Saleh, H., Rodgers, L., Andringa, P., Arenas, I. D. L. T., Campbell, C., Bernard, S., Bhandari, A., & Joiner, S. (2024, October 9). Inside one family's journey through the Israel-Hamas war. *Financial times*. https://ig.ft.com/gaza-one-year/

Segel, E., & Heer, J. (2010). Narrative visualization: Telling stories with data. *IEEE Transactions on Visualization and Computer Graphics*, *16*(6), 1139–1148. IEEE Transactions on Visualization and Computer Graphics. https://doi.org/10.1109/TVCG.2010.179

Small, D. A., Loewenstein, G., & Slovic, P. (2007). Sympathy and callousness: The impact of deliberative thought on donations to identifiable and statistical victims. *Organizational Behavior and Human Decision Processes*, *102*(2), 143–153. https://doi.org/10.1016/j.obhdp.2006.01.005

Smith, K. E., & Anderson, R. (2018). Understanding lay perspectives on socioeconomic health inequalities in Britain: A meta-ethnography. *Sociology of Health and Illness*, *40*(1), 146–170. https://doi.org/10.1111/1467-9566.12629

Smith, K. E., & Garthwaite, K. (2015). 6-contrasting views on ways forward for health inequalities research. In K. E. Smith, C. Bambra, & S. E. Hill (Eds.), *Health inequalities: Critical perspectives* (pp. 0). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198703358.003.0006

Sundar, S. S. (2003). News features and learning. In J. Bryant, D. R. Roskos-Ewoldsen, & J. Cantor (Eds.), *Communication and emotion: Essays in honor of Dolf Zillmann* (pp. 275–296). Lawrence Erlbaum Associates.

Temmann, L. J., Wiedicke, A., Schaller, S., Scherr, S., & Reifegerste, D. (2021). A systematic review of responsibility frames and their effects in the health context. *Journal of Health Communication*, *26*(12), 828–838. https://doi.org/10.1080/10810730.2021.2020381

Tsang, S. J. (2023). Communicating climate change: The impact of animated data visualizations on perceptions of journalistic motive and media bias. *Journal of Broadcasting and Electronic Media*, *67*(2), 161–182. https://doi.org/10.1080/08838151.2023.2182788

Tyner, J. A. (1982). Persuasive cartography. *Journal of Geography (Houston)*, *81*(4), 140–144. https://doi.org/10.1080/00221348208980868

Westerveld, L., & Knowles, A. K. (2021). Loosening the grid: Topology as the basis for a more inclusive GIS. *International Journal of Geographical Information Science*, *35*(10), 2108–2127. https://doi.org/10.1080/13658816.2020.1856854

Zillmann, D. (1999). Exemplification theory: Judging the whole by some of its parts. *Media Psychology*, *1*(1), 69–94. https://doi.org/10.1207/s1532785xmep0101_5

Zillmann, D., & Brosius, H.-B. (2000). *Exemplification in communication: The influence of case reports on the perception of issues*. Lawrence Erlbaum Associates Publishers.