

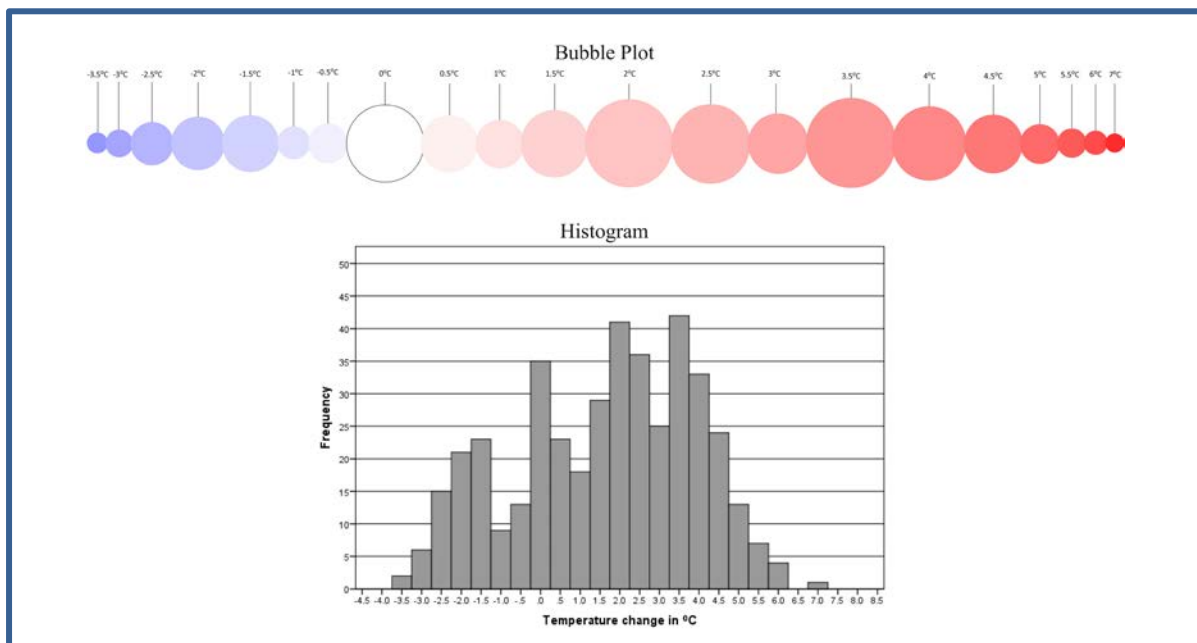


SRI Briefing Note Series No.7

Testing the effectiveness of climate projections visualisations with adaptation practitioners

Susanne Lorenz, Suraje Dessai, Piers M. Forster and Jouni Paavola

November 2015



<http://www.see.leeds.ac.uk/sri/>

Tailoring the visual communication of climate projections for local adaptation practitioners in Germany and the UK

SUMMARY

Visualisations are widely used in the communication of climate projections but their effectiveness has rarely been assessed amongst their target audience. To address this we conducted an on-line survey with 162 local adaptation practitioners in Germany and the UK. We showed that even within a fairly homogenous user group there are clear differences in respondents' comprehension and preference for visualisations. The findings suggest that audience-specific targeted communication may be more complex and challenging than previously recognised.

Key Messages

- 1. People use what they think they understand rather than what they actually understand.**
- 2. Some audiences are more susceptible to changes in graph format than others, so the same solution may not work in all situations.**
- 3. It is not always possible to judge what visualisations will be effective without empirical testing.**
- 4. Co-design of the visual presentation of climate information needs to be an integral part of the co-production process.**
- 5. Different visualisations are more persuasive at different stages of adaptation planning.**

Some form of adaptation to climate change is now seen as inevitable¹. If we are to provide effective decision-support for adaptation, then climate projections need to be useable by those decision-makers that have to prepare and plan for the impacts of climate change, namely adaptation practitioners².

Germany and the UK are amongst those leading the way on climate change adaptation and so were chosen as the location for this study. Our intention was not to find one ideal visualisation but rather to highlight the complexities involved in tailoring and improving the usability of climate information.

Study Design

Four graph formats were used to visualise the output of 14 General Circulation Models (Figure 1).

These included two traditional formats (linear scatter plot and histogram) and two alternative formats (pictograph and bubble plot). The graphs were presented in the following pairs:

- Scatter plot & pictograph
- Histogram & bubble plot

Each graph within the pair showed the same underlying data.

The survey was designed to examine 4 key criteria (Figure 2):

- Assessed comprehension
- Perceived comprehension
- Use by self
- Use for showing to others

The latter two criteria were included as adaptation practitioners not only use climate information for their own planning, but also communicate it on to colleagues, managers or elected representatives in order to inform or persuade others.

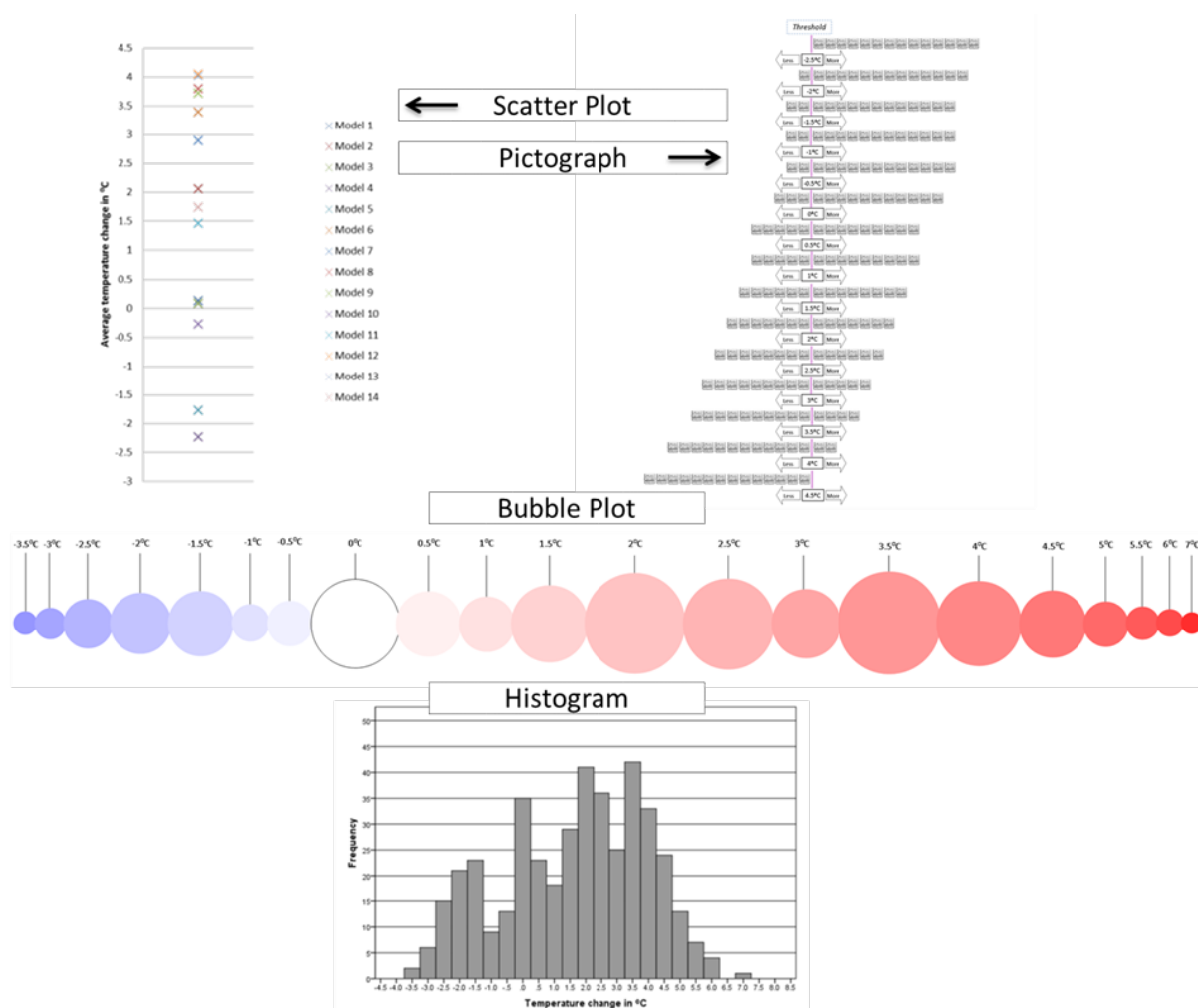


Figure 1 This shows the four graph formats that were used in the survey. Each one of them also contained a figure caption explaining the data and the concept of the figure.

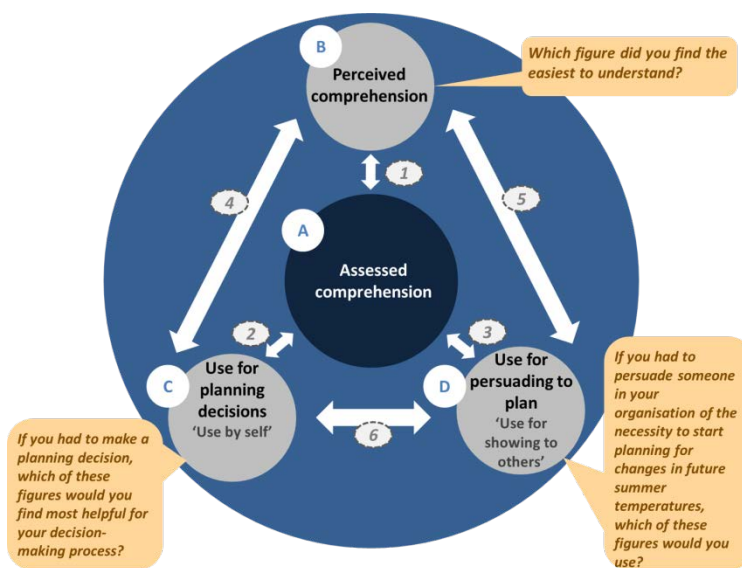


Figure 2 The four key criteria are labelled as follows:

- (A) assessed comprehension,
- (B) perceived comprehension,
- (C) use for planning decisions – i.e. use by self,
- (D) use for persuading to plan – i.e. use for showing to others.

Relationships between the criteria were analysed. These associations are represented with the numbered arrows (1-6).

Sample

A total of 162 survey responses were collected: 99 from the UK and 63 from Germany. Overall the two samples were comparable, although the German sample had a slightly higher percentage of older respondents with more years of relevant work experience. We did not find any systematic effects due to socio-demographics, or self-assessed knowledge, experience or numeracy.

Assessed comprehension

In the German sample, the graph format did not significantly affect the assessed comprehension. However, for the UK sample, the pictograph stood out as having a low assessed comprehension score.

The findings suggest that showing respondents different graph formats might not make too much of a difference unless the graph formats differ widely from what the respondents are used to, in which case, assessed comprehension seems to be lower.

Perceived comprehension

There were no significant differences between countries on the scores for perceived comprehension. Both groups selected the histogram as the figure that was easiest to understand, followed by the bubble plot, scatter plot and pictograph last.

Use by self and use for showing to others

For both UK and Germany samples, the histogram was the most popular format for 'use by self' and 'showing to others'. Written survey responses gave three key reasons:

- 1) Familiarity of graph format
- 2) Perceived clarity of display
- 3) Perceived ease of readability of frequencies

However, second place was different for 'use by self' versus 'showing to others'. For 'use by self' the scatter plot was the second most popular format, whereas for 'showing to others', the bubble plot came second. Written explanations suggest that the bubble plot was considered to be more visually persuasive and a good 'initial hook' for discussions.

This difference suggests that some visualisations may lend themselves more to particular communication aims.

Assessed comprehension compared to perceived comprehension and use

Assessed comprehension was compared to perceived comprehension and use (see 1, 2 & 3 on Figure 2). No consistent associations were found between assessed comprehension and the other criteria. This indicates that people are poor at identifying the formats they actually understand best and do not choose to use what they understand best.

Perceived comprehension compared to use

Perceived comprehension was compared to 'use by self' and 'showing to others'. In addition, the two 'use' criteria were also compared (see 4, 5 & 6 on Figure 2).

We found consistently strong links between all three criteria in both the UK and German samples. In most cases, respondents picked the figure they perceived as easiest to understand as the one they would both use themselves and show to others. However, this was not always the case. For example, many respondents that picked the scatter plot as easiest to understand would still pick the histogram to use for planning ('use by self').

While perceived comprehension and use are strongly associated and respondents' preferences are mostly consistent, the lack of association of the three preference measures

with assessed comprehension indicates that respondents tend to use what they think they understand best, rather than what they actually understand best.

The results are summarised in Figure 3 below.

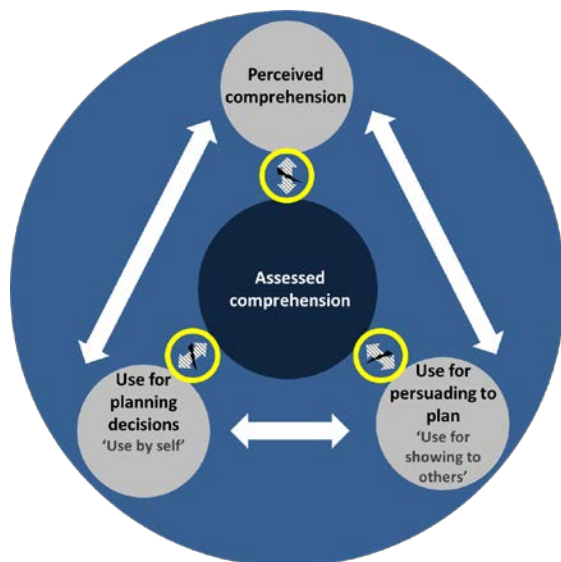


Figure 3 Associations between the four key criteria showing on the one hand the disconnect between users’ assessed comprehension and the other three key criteria, and on the other hand the strong relationship between perceived comprehension and use by self and use for showing to others

Conclusions

The aim of the study was to explore empirically the relationship between assessed and perceived comprehension for different forms of visualisation amongst adaptation practitioners in the UK and Germany.

Our findings show a gap between users’ assessed comprehension and perceived comprehension. However, there is a strong link between people’s perceived comprehension and their preference for graph formats. Similar findings have been also reported in the health science literature

where it has been shown that familiarity plays a bigger role in making sense of graphs than actual comprehension of the information^{3,4}.

We have shown that some audiences are more susceptible to changes in graph format than others. The impact of innovative designs may thus depend on issues such as audience familiarity, their willingness to engage and the different demands placed on them by their jobs or work place. This further highlights the importance of empirically testing visualisations, as such complex influences make it hard to judge at the outset what the best solution will be for a given situation.

Some consideration should also be given to matching visualisations to communication aims. Respondents highlighted that graph formats such as the bubble plot are better for initial persuasion needed to ensure buy-in into adaptation, whereas other formats communicate better the exact data needed for more specific adaptive measures.

Visual information provision is only a small part of a much more extensive process of producers and users working together to develop useable climate information (co-production). However, given the extensive use of visualisations in the communication of climate projections, we would call for the co-design of the visualisation to be integrated and prioritised from the beginning.

Acknowledgements

Susanne Lorenz is funded by the UK Natural Environment Research Council (NERC) (grant number NERC-NE/J50001X/1). Suraje Dessai is supported by the European Research Council under the European Union’s Seventh Framework Programme (FP7/2007 2023)/ERC Grant agreement no. 284369 and 308291. Jouni Paavola acknowledges the support of the UK Economic and Social Research Council (ESRC) for the Centre for Climate Change Economics and Policy (CCCEP).

References

1. Moss RH, Meehl GA, Lemos MC, Smith JB, Arnold JR, Arnott JC, Behar D, Brasseur GP, Broomell SB, Busalacchi AJ, Dessai S., Ebi KL, Edmonds JA, Furlow J, Goddard L, Hartmann HC, Hurrell JW, Katzenberger JW, Liverman DM, Mote PW, Moser SC, Kumar A, Pulwarty RS, Seyller EA, Turner BL II, Washington WM, Wilbanks TJ. Hell and high water: practice-relevant adaptation science. *Science*, 2013; 342(6159): 696-698. (doi: 10.1126/science.1239569)
2. Lehmann P, Brenck M, Gebhardt O, Schaller S, Sussbauer E. Barriers and opportunities for urban adaptation planning: analytical framework and evidence from cities in Latin America and Germany. *Mitig Adapt Strateg Glob Chang*. 2015; 20(1):75-97
3. Parrott R, Silk K, Dorgan K, Condit C, Harris T. Risk comprehension and judgments of statistical evidentiary appeals. *Human Communication Research*. 2005; 31(3):423-52. (doi: 10.1093/hcr/31.3.423)
4. Elting LS, Martin CG, Cantor SB, Rubenstein EB. Influence of data display formats on physician investigators' decisions to stop clinical trials: prospective trial with repeated measures. *British Medical Journal*. 1999; 318(7197):1527-31. (doi: 10.1136/bmj.318.7197.1527)

About the Sustainability Research Institute

The Sustainability Research Institute conducts internationally recognised, academically excellent and problem-oriented interdisciplinary research and teaching on environmental, social and economic aspects of sustainability. We draw on various social and natural science disciplines, including ecological economics, environmental economics, political science, policy studies, development studies, business and management, geography, sociology, science and technology studies, ecology, environmental science and soil science in our work.

About the Authors

Susanne Lorenz is a postdoctoral researcher in the Sustainability Research Institute, School of Earth and Environment, University of Leeds. This work arose from her PhD research.

Suraje Dessai is Professor of Climate Change Adaptation in the Sustainability Research Institute, School of Earth and Environment, University of Leeds.

Piers Forster is Professor of Physical Climate Change and Royal Society Wolfson Merit Award Holder based at the School of Earth and Environment, University of Leeds.

Jouni Paavola is Professor of Environmental Social Science and Deputy Director of the ESRC funded Centre for Climate Change Economics and Policy (CCCEP) in the School of Earth and Environment at the University of Leeds.

Further Information

Information advising this policy brief is taken from an academic paper entitled 'Tailoring the visual communication of climate projections for local adaptation practitioners in Germany and the UK' in *Philosophical Transactions A*, 2015; volume 373, issue 2055. DOI: [10.1098/rsta.2014.0457](https://doi.org/10.1098/rsta.2014.0457) (open access)

For more information, please contact:

Susanne Lorenz
Sustainability Research Institute, University of Leeds, Leeds, LS2 9JT
S.Lorenz@leeds.ac.uk



UNIVERSITY OF LEEDS

Suggested Citation:

Lorenz, S., Dessai, S., Forster, P.M., Paavola, J. 2015 Testing the effectiveness of climate projections visualisations with adaptation practitioners. Sustainability Research Institute Briefing Note Series No. 7. University of Leeds