

PSYCHOLOGY

Climate uncertainty communication

The consequences of global warming will be dire, but the full extent of these effects on society is unknown and includes uncertainties. Research now suggests that how scientists communicate about the uncertainty over such climate change impacts can influence the public's trust and acceptance of this information.

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Climate change and its associated impacts create major and multi-faceted policy questions shrouded in uncertainty. The uncertainty lies in the natural variability in the environment that renders precise predictions intractable. Even when some climate change impacts from, say, sea level rise caused by human activities can be quantified, it is harder to predict the exact magnitude of the second-order consequences, such as storms that are caused by this rise. The diffuse nature of climate change, its many sources of uncertainty and second-order issues such as impacts arising from issues that the event triggers all make it difficult to capture public concern¹. Writing in *Nature Climate Change*, Lauren Howe and colleagues² look at how fully acknowledging the uncertainty in global warming impacts can undermine trust in such information and acceptance of it.

In communicating about uncertainty associated with climate change, there is a delicate balance to be struck between being too precise³, which can lead to overconfidence in perceived accuracy, or making overtly vague statements (for example, "There is a possibility that sea level rise will occur in the near future"), which contain less information than evinced by scientific consensus. Furthermore, one needs to be sensitive to the fact the uncertainty is often interpreted by the audience differently than intended by the communicators⁴. Given these uncertainties, it was previously suggested that conveying the inherent complexities and lack of predictability in the climate system was an appropriate scientific communication strategy⁵.

In the study by Howe et al., a representative sample of participants from the United States read about predictions of the effects of global warming on sea level rise in two different frames. In one frame, uncertainty was expressed in terms of a range (for example, "global warming will cause sea level to rise about four feet, but it could be as little as one foot or as much as seven feet"). In the other frame,



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the predictions were qualified by the acknowledgement that there are certain impacts (for example, storms induced by global warming) that could influence sea level rise in unpredictable ways (that is, stressing the "irreducible uncertainty"). Participants were asked about the extent to which they accepted the scientist's predictions and how much they trusted the scientists.

Previous work has shown that public trust in scientists and belief that climate change is occurring can be fragile and susceptible to framing effects⁶. Howe and colleagues found that reading fully bounded uncertainty estimates of sea level rise (the first framing) increased trust in scientists, which in turn increased message acceptance, compared with a control group who received only a 'best-guess' prediction without bounded certainty statements. However, when information about the unpredictability of impacts was included (the second framing), the effect reversed: participants trusted scientists less, and this reduced the acceptance of their message.


This suggests that while fully bounded uncertainty can promote understanding of and concern about climate change and its consequences, there are limits to this receptiveness to uncertainty. Much attention has been given to uncertainty quantification in climate models, but the work of Howe and colleagues shows that subtle changes in the format of communication of the state-of-the-art science can affect the way that the message is perceived by the target audience. This is the main take-home policy message of their paper, and it raises the question of the best way to communicate uncertainty.

The work by Howe and colleagues² provides a blueprint for future work on the effectiveness of communication about climate impacts, one that can lead to useful practical guidelines. They are to be applauded for using a nationally representative sample and for carefully designing alternative frames to address specific research questions. They find that uncertainty that is fully bounded increases message acceptance, but uncertainty that

admits to a lack of resolution appears to muddle the public's confidence in climate change messaging. In other words, efforts to be more comprehensive, and very conservative, may have the unintended effect of eroding trust in the messenger and the message.

It is important to understand why the qualification about irreducible uncertainty had such a negative impact. One possibility is that while the original passage places an upper bound on sea level damage at 7 feet, the characterization of impact unpredictability provided two additional upper bounds exceeding the original estimate. This particular formulation, deemed by the authors to be “irreducible uncertainty”, could be easily interpreted as conveying deep scientific disagreements and, as such, undermines the trust in the source(s). Indeed, recent work has shown that people are averse to conflict between sources but are more open to equal levels of imprecision⁷.

The challenge for future research is to identify and validate communication methods that are accurate, transparent, effective and preserve trust in the messenger(s) and their message. One particular approach that could achieve this, and should be tested empirically, is to abandon the norm of specifying symmetric intervals, where the lower and upper bounds are equally distant from the best estimate, in favour of asymmetric ones where the worst-case scenario stands out by being, clearly, more extreme. Such intervals could be effective, provided that they do not become too wide and perceived as uninformative⁸. Endeavours from the scientific community to promote more widespread acceptance of climate change and its consequences may benefit from a careful, evidence-based assessment of how to design and tailor communication to the public to increase awareness and promote collective action about the mounting seriousness of climate change impacts. □

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References

1. Ho, E. H., Budescu, D. V. & Por, H. H. in *Oxford Research Encyclopedia of Climate Science* <https://doi.org/10.1093/acrefore/9780190228620.013.381> (Oxford Univ. Press, 2017).
2. Howe, L., MacInnis, B., Krosnick, J., Markowitz, E. M. & Socolow, R. *Nat. Clim. Change* <https://doi.org/10.1038/s41558-019-0587-5> (2019).
3. Moore, D. A. & Schatz, D. *Soc. Personal. Psychol. Compass* **11**, e12331 (2017).
4. Budescu, D. V., Por, H.-H., Broomell, S. B. & Smithson, M. *Nat. Clim. Change* **4**, 508–512 (2014).
5. Center for Research on Environmental Decisions (CRED). *The Psychology of Climate Change Communication: A Guide for Scientists, Journalists, Educators, Political Aides, and the Interested Public* (CRED, 2009).
6. Kause, A., Townsend, T. & Gaissmaier, W. *Weather Clim. Soc.* **11**, 199–215 (2019).
7. Benjamin, D. M. & Budescu, D. V. *Front. Psychol.* **9**, 403 (2018).
8. Yaniv, I. & Foster, D. P. *J. Exp. Psychol. Gen.* **124**, 424–432 (1995).