Perspective

Explaining uncertainty: a scientist's perspective

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Modern public policy challenges are frequently complex and require the expertise of a broad range of disciplines covering both the natural and human sciences.

The Anthropocene – the new geological epoch in which human activity is affecting all life on the planet – is an example. It requires input from all science disciplines to meet the challenges of climate change, food, water, energy, population and health. There is no worldwide or government agency, research organisation, or NGO that has the mission or the scientific expertise to address the challenges of the Anthropocene.

Solving such complex and often ill-defined issues – so-called 'wicked problems' – frequently requires science with levels of uncertainty that are large and difficult to quantify. Those high levels of uncertainty can diminish the buy-in from policymakers, funding agencies and the wider community.

Nevertheless, there is a responsibility on the scientific community to articulate uncertainty even if the possible scenario outcomes of policy decisions are varied and difficult to precisely quantify. Scenario building – where the results of policy choices are explored in depth – and the plotting of trajectories with their associated uncertainties will be key tools for applying science to public policy.

To further complicate the issue, when it comes to government planning, the challenges of the Anthropocene require global environmental and societal responses, but face a policy vacuum. Scientific uncertainty can act as a pretext for government policy uncertainty or even paralysis; when the opposite is needed to provide a firm direction whose consequences can be tracked over time. The short-term election cycle and multiple layers of government further compound disjointed decision-making, whereas long-term, coordinated solutions are required.

Uncertainty also opens a window of opportunity for people opposed to the science who try to promote the idea that 'scientists don't know what they're doing'. This is exacerbated by the explosion of information available on the Internet, little of which is scrutinised for scientific validity. This wealth of unvetted information means that people can more easily cherry-pick ideas that best match their world-view, thereby presenting opportunities for opinion to polarise sympathetically around anti-science perspectives.

This has serious implications for science communication. Complexity and uncertainty make it difficult to communicate the science needed to address wicked problems. This encourages simplistic, knee-jerk responses that may appeal to non-experts. Opportunities to spread mis- information also abound, and in particular, public 'debates' on complex scientific issues can be confusing, and can't adequately convey the scientific consensus.

At both The Australian National University's Energy Change Institute and Climate Change Institute we are keen to present the scientific consensus and to answer people's questions – but not to debate the science.

We take this stance for a number of reasons: because complexity and uncertainty need to be articulated comprehensively rather than in sound-bites, and not mis-used to confuse the picture; because the most appropriate forum for debate is in the scientific arena, where evidence can be rigorously scrutinised; because adversarial one-on-one debates cannot reflect the true scientific consensus; and because debates give oxygen to misinformation and 'anti-science'.

When it comes to establishing the knowledge needed to solve wicked problems, attempts to systematically identify perceived knowledge gaps may be even more distracting than a random, inquiry-led knowledge evolution. It is unlikely that setting prescriptive, national, discipline-based science priorities will address knowledge gaps in the solution of interdisciplinary wicked problems such as climate change or food security.

The complexity of the challenges that life in the Anthropocene poses also leads to funding gaps in the search for solutions. For example, funding for the Australian Research Council and other national competitive grants programmes is

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largely divided into scientific discipline groupings. If we really want to find solutions to these wicked problems, specifically identified trans-disciplinary and whole-of-science research funding is critical.

Most importantly, we need to recognise the complexity of the world we live in and how, more often than not, most things are connected; including the solutions to our problems.

Finally, immediate, clear and present, close-to-home priorities often conflict with long-term, global priorities that are required to address complex and uncertain challenges. Responding to these challenges needs to become a national priority in a way that will assist – not conflict with – other economic, strategic and social priorities.

It's clear that if we want to find solutions to the challenges of the Anthropocene and other pressing public policy issues we not only require a whole-of-science approach, but also a whole-of-planet and a whole-of-government approach. We, as scientists, also need to better communicate scientific uncertainty through trajectories and scenario building. These steps will help minimise government policy uncertainty, which in turn will provide certainty to industry and the wider community - something that will benefit everyone.