COMMENTARY:

Copenhagen II or something new

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For the first time since the failed 2009 Copenhagen Climate Change Conference, momentum is building towards a new climate agreement. But expectations must be kept in check, and making expert advice more useful to the process will require engaging the social sciences more fully.

Another season of climate diplomacy is under way. In September, the United Nations Secretary General will host a summit of world leaders aimed at focusing political attention on the need for more stringent policies. A few months later, in December in Lima, diplomats will take stock of their efforts to negotiate a new global agreement that would take over before the Kyoto Protocol expires in 2020. After Lima, a spate of diplomatic events during 2015 will culminate at a December summit in Paris, when governments are expected to sign the new climate accord.

While this surge of diplomacy is promising, there are also disturbing parallels with the diplomatic run-up to the Copenhagen Climate Change Conference in 2009 — an event that also had aspired to produce an agreement that would replace the outdated Kyoto treaty, but which ended in a fizzle of disagreement and dashed expectations. In the year or so before Copenhagen there were, like today, many bold pronouncements but few specifics. Massive disagreements over who would pay the cost of controlling emissions and adapting to climate change loomed large with no serious solutions in sight. And like today, the pre-Copenhagen process saw negotiators dither in the painstaking work of actually drafting an agreement — leaving too much to the final moments[1].

Will Paris be another Copenhagen? While most answers to that question hinge on how politicians and diplomats behave, the scientific community can help raise the odds of success in Paris and beyond. Part of what science can do has been done: over the past 12 months the IPCC has released three massive new assessments of climate science[2–4]. While important uncertainties will always remain, the IPCC's new assessment — the first since 2007 — credibly demonstrates that the scientific case for action to cut emissions is stronger than ever.

Making the case that climate change is a serious problem is just one of many ways

that science could guide how governments approach the policy challenges in crafting new agreements on climate change. But nearly all the information that governments really need for policy will require that scientific researchers move into unfamiliar and uncomfortable territory. Real policy in this domain won't simply be guided by the pure facts and analysis that the IPCC excels at answering in ever-finer resolution. What really matters now are answers to questions about human behaviour, including political action — the realm of social sciences and the humanities that the IPCC and governments have been most uncomfortable letting into the room.

A reminder of why these issues are so important appears in a Perspective by Raupach *et al.* in a Focus (http://dx.doi.org/10.1038/nclimate2384). Raupach *et al.* take a fresh look at the age-old question of how to set fair quotas for controlling emissions. Climate change implicates fairness in many different ways — between peoples and countries as the gases mix globally, and also across generations because the gases that cause warming build up in the atmosphere[5,6]. So far, despite many studies on climate fairness by physical scientists, there isn't much evidence of this work affecting real policy decisions. How can we do better?

In some idealistic world, governments might separate the decisions about how much warming is tolerable from the choices about who pays for policy action. The vast majority of supposedly policy-relevant climate science seems to be organized around this vision of the world. There are endless studies looking at the best global goals for limiting warming, along with ample research that shows the least-cost globally optimal ways to cut emissions. Indeed, diplomats themselves have perpetuated this fictitious view of the world by setting abstract global goals such as limiting global warming to 1.5 to 2 °C above pre-industrial levels. Quite apart from whether it makes any technical sense to set goals in

terms of naturally variable globally averaged atmospheric temperature[7], this naive view of the world has focused too much scientific talent on abstract goals and not enough on understanding the practical actions that individual governments, firms and individuals would take to meet global goals.

Rather than an idealistic vision of a world in which goals can be removed from who pays for them, making science more useful for policy will require adopting a more realistic view of how international political decisions are made. Individual countries can decide, largely on their own, what is in their interest. Collective action is feasible, of course, but it emerges 'bottom up' from individual national interests rather than 'top down' by starting with abstract global goals and schemes for optimal burden sharing. One reason I am more optimistic about the outcome in Paris when compared with Copenhagen is that there is much more talk among diplomats these days about how the Paris accords will be 'bottom up' instead of 'top down'. That shift in language has been treated by policy analysts as some grand shift in diplomatic strategy[8], but the reality is that 'bottom up' has always been how diplomacy works in a world that has no central government[9].

What about fairness? In the late 1980s, one of the earliest papers on climate policy strategy argued that every country should be assigned an equal per-capita quota of emissions[10]. Related studies soon focused on how those per-capita targets might converge over time in ways that reflected not just immediate emissions but also the long-term accumulation of emissions in the atmosphere[11]. An avalanche of studies has since examined many other imaginary schemes for burden sharing[12]. The Perspective by Raupach *et al.* looks at two extremes — one rooted in today's allocation of emissions and the other in a scheme that assigned equal per-capita allocations for cumulative emissions. Neither of these extremes is feasible for political reasons, say Raupach *et al.*, so the authors looked at

blending the two extremes. They invented a new scalar coefficient w that is simply the ratio of the two burden-sharing principles. With $w = 1$, quotas are set for pure physical equality across all people. The other extreme, $w = 0$, is the nasty, brutish real world where inertia reigns and big emitters keep using the largest share of the global quota. Some master planetary decider sets the value of w exogenously, and Raupach *et al.* find that middling values seem to work best.

Making this kind of analysis really useful for policy will require work on at least two fronts. One is to look at burden sharing in terms that real governments care about — human welfare, such as dollars of economic loss and gain — rather than purely physical terms such as tons of emissions. Doing so will help make more transparent how costs and benefits unfold over time, which is the key to understanding how climate policy will affect fairness between generations. Luckily, economics is the one social science that has become engaged in many fronts of climate research, so bringing economists more centrally into the picture will be relatively easy[13].

The second front will be a lot harder. Rather than treating all of politics as an exogenous scalar choice, it is important to find ways to endogenize w. The reality is that different governments will choose their own course of action — and those choices, in turn, will drive w as a vector rather than a discrete, single global decision. Endogenizing that process in our models would help us understand where governments might make different choices and would help us better predict and inform real-world outcomes. Doing that requires engaging political scientists — a discipline that, so far, has been strikingly absent from most global change research[14]. (Full disclosure: I was trained in political science and most of what I do in the realm of climate change science is seen as an oddball activity in my discipline.)

Getting serious about fairness and burden sharing is only one of the many realms where teams of scientists working across disciplines could yield insights into human behaviour that will be much more relevant for policy. Other examples include the insights now emerging from the cognitive revolution that has been sweeping across the social sciences. No longer is it possible to assume, simply, that humans are rational and care only about maximizing their own individual welfare. Instead, humans care about much more and they make decisions in ways that are predictably irrational. Yet so far, practically none of these insights are reflected in the study of climate policy.

This revolution can inform how humans value nature and other intangibles — which is important, as a central conclusion from the IPCC is that the impacts of climate change on unmanaged natural ecosystems will be especially large[3]. Looking at other areas of grand global policy — such as the long-term evolution of bans on slavery[15] — what becomes clear is that it is the often gradual accretion of new social norms about what is appropriate that really matters[16]. A norm against polluting nature is spreading. As it diffuses, its impact on what people want and thus what governments can implement through international cooperation could be huge. Apart from some crude polling, we are doing little to measure and predict diffusion of that norm.

This cognitive revolution matters because the extreme interpretation of 'bottom up' diplomacy is that countries will be self-obsessed and that 'fairness' doesn't matter. Yet, in reality, human decision-makers often pay close attention to fairness even when adherence to that norm comes at a personal cost. Cognitive scientists are also learning a lot about how people make strategic decisions — that is, decisions where the best course of action depends on the expectations of how others will respond[17]. Real experiments on elite policymakers have revealed that most decision-makers are much less strategic than assumed in hyper-rational models of bargaining[18], and that bodes well for cooperation, as hyper-rational decision-makers also tend to be hyper-selfish. One of the reasons that global climate policy is so difficult to manage is that it involves highly strategic national choices. That has led many to assume that a tragedy of the commons will foul the planet as diplomats representing each nation think only about themselves; the evidence from real humans, who are more cooperative and often learn from mistakes, is a bit more upbeat.

Across many other realms of the human sciences, I see a golden age of climate change research that has barely begun. Serious work in this area will require working in teams with people from disciplines that, so far, have barely had any presence in the climate science community. It will require that physical scientists realize that many of the variables they treat as exogenous political choices — such as w or the choice of time horizons for global warming potentials — are actually matters for research rather than just political choices.

Making use of these insights, as they emerge, will probably also require new models for assessment. The IPCC has worked well for some sciences, but most of the social sciences and humanities offer insights that are too contentious for the IPCC to handle. The

system of aggressive review, re-review and re-re-review along with government approval of final documents (and line-by-line approval of key summaries) is good at weeding out errors and building consensus around facts. But almost everything interesting in the behavioural sciences is tinged with values[19] that some reviewer or government will find objectionable. I doubt that the ponderous, centralized IPCC-style assessment will work in these settings just as 'top down' diplomacy doesn't work when it implicates many decentralized, autonomous actors[20].

Delivering on this agenda won't happen before the Paris climate conference, but awareness of these insights can help keep expectations in check. It is highly unlikely that the Paris summit will deliver an accord that limits warming to 2 °C, and hopes for that outcome in the scientific community are built on a naive vision that science sets goals and that politicians, once they shed the scales from their eyes, will follow in lockstep. Awareness of what the behavioural sciences can bring suggests, as well, that the era of really important climate science is perhaps just beginning. ❑

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