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The IPCC's Interdisciplinary Dilemma: What Natural and Social Sciences Could (and Should) Learn from Physics

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Insights captures the ideas and work-in-progress of the Fellows of the Institute of Advanced Study at Durham University. Up to twenty distinguished and 'fast-track' Fellows reside at the IAS in any academic year. They are world-class scholars who come to Durham to participate in a variety of events around a core inter-disciplinary theme, which changes from year to year. Each theme inspires a new series of *Insights*, and these are listed in the inside back cover of each issue. These short papers take the form of thought experiments, summaries of research findings, theoretical statements, original reviews, and occasionally more fully worked treatises. Every fellow who visits the IAS is asked to write for this series. The Directors of the IAS – Veronica Strang, Rob Barton, Nicholas Saul and Martin Ward – also invite submissions from others involved in the themes, events and activities of the IAS. *Insights* is edited for the IAS by Nicholas Saul. Previous editors of *Insights* were Professor Susan Smith (2006–2009), Professor Michael O'Neill (2009–2012) and Professor Barbara Graziosi (2012–2015).

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THE IPCC'S INTERDISCIPLINARY DILEMMA: WHAT NATURAL AND SOCIAL SCIENCES COULD (AND SHOULD) LEARN FROM PHYSICS

An ambitious goal of 1.5°C in average temperature change was set by the global climate treaty at the Conference of the Parties in Paris 2015. To meet that goal, it has become clear that the social sciences need to contribute more to the IPCC's interdisciplinary project. Despite this consensus, however, natural science approaches and practices continue to dominate the debates on climate change. In particular, social sciences are expected to contribute viable and highly synthesised concepts for managing the transition to low-carbon societies. This approach, however, asks for something the social sciences alone cannot deliver. Rather, a different mindset is called for. In physics, for example, there coexists a plurality of competing, yet equally valid, paradigms. Both Newtonian and quantum physics offer valid perspectives on the world, even though they cannot be unified in a single standard model. Just as in physics there exist paradigm differences between natural sciences and social sciences/humanities which, although equally valid, cannot easily be bridged. It is argued therefore that mutual recognition and acceptance of the differences would be an essential step towards interdisciplinary cooperation facing the necessary transition.

Keywords: IPCC; interdisciplinarity; social-ecological transformation; bridging the gap between natural and social sciences/the humanities.

For some time now interdisciplinary research has been recognised as *foundational* to academic practice, especially when it comes to complex problems such as global environmental change and – related to this – the imperative transition to low-carbon societies. Taking the IPCC as an example for highly efficient and successful interdisciplinary research, it is clear that the contributing research groups are still dominated by natural scientists and their approaches. Thanks to their work, the Conference of the Parties in Paris 2015 (COP 21) delivered an ambitious global climate treaty, which can serve as the reference point for the social transformation process. The time therefore seems to be ripe for the social sciences and humanities to contribute fully to the IPCC. Accordingly, the organisers of this year's German IPCC Annual Conference (29 February–1 March in Nauen, near Berlin) explicitly invited social scientists to the meeting. There, the newly-elected co-chair of the IPCC's Working Group II, Hans-Otto Pörtner, concluded his keynote lecture with a clear message aimed at the social sciences. In addition to further outcomes from the natural sciences, he noted, the next Assessment Report of the IPCC will have to compare, the:

- socioeconomics of impacts, adaptation under different emission scenarios,
- 'solution pathways' with respect to impacts, and the constraints and trade-offs in adaptation and mitigation,
- regional impacts, adaptation, mitigation impacts,

• balancing adaptation and mitigation considering psychosocial aspects (Pörtner, 2016).

Additionally, Pörtner registered his 'very high expectations' of social scientists who should facilitate the transformation towards a low-carbon society.[1] To do this, Pörtner emphasised that social scientific models, concepts and results should 'meet IPCC standards and be "synthesised similarly" to those of natural sciences'.[2] Attenders with a background in social sciences responded that this expectation simply cannot be met, pointing to the different nature of research in social sciences: that research results are embedded in specific contexts and are often case studies, that they depend on the applied theories or thinking styles ('Denkstil', following Fleck, 1980) and that findings as a consequence can hardly be compared or generalised (which is even more difficult on an international level).[3] In this debate, the conference succeeded only in reproducing the long-established methodological and epistemological dualism between natural sciences on the one side and social sciences/humanities on the other. However, despite the differences in their demands regarding research results, the participants at the conference strongly agreed on the need for close collaboration between natural sciences, social sciences and the humanities to face climate change – quite a contradiction, leaving open the question of how to do it. Despite the growing literature on the necessity of interdisciplinary academic practice (cf. for instance Strang and McLeish, 2015; Krauss, 2014), the question of how to establish interdisciplinary research which is more than merely additive to the usual discipline-based research and which bridges the huge gap between natural and social sciences/humanities is still unresolved. In this context, a meta-perspective might be worth a try. Thus, this paper deploys the two currently competing approaches in physical causality, Newton and quantum, resultant and emergent, linearity and non-linearity as *allegories* for the differences in the arguments mentioned above. It will argue that relating the debate to physics is not about physics itself but rather about what we could learn from it derivatively.

In his expectations of the social sciences (which also represent *grosso modo* the IPCC attitude), Pörtner referred to a natural scientific perspective which has its background in Newtonian physics and their general assumption that all phenomena follow the laws of natural science[4] and can be attributed to some specific prior cause. Phenomena that appear to be random are understood as merely the result of a lack of information. In *principle*, however, they are regarded as calculable and predictable when all relevant characteristics have been captured. Werner Heisenberg (1955) called this 'subjective randomness', in that objectively there is of course no chance, however, since we do not know all the relevant parameters the outcome is *perceived* as random. In short, based on their implicit general assumptions of Newtonian physics, natural scientists expect social sciences to deliver results similarly structured to those of the natural sciences, assuming that social and cultural phenomena can be approached on the same basis and in a comparable manner.

By contrast, quantum physics (apart from certain highly specific givens) frustrates our traditional world view of linear cause and effect. Experiments with light and particles show that the behaviour of a single unit cannot be predicted, since neither the observer nor the particle itself knows how it will behave in advance. Thus, not 'subjective' but 'objective' randomness plays a major role in determining outcomes, for which, according to our knowledge today, no cosmography of cause and effect can be deployed (Zeilinger, 1996). In this, quantum physics contradicts the fundamental programme of classical physics, i.e. to find causes for all phenomena and to be able to predict their outcome. In quantum physics, predictions can only be made on the basis of statistics and probabilities, since the results in a number of experiments follow the physical laws of distribution even if the single event does not follow any causality.[5] Rather than a world of linear cause and effect of Newtonian physics, the world of quantum physics is a world of

possibilities, or (in social sciences language) of contingencies, in which 'objective' randomness dominates.

Additionally, it is also thanks to quantum physics that the role of the observer has moved into focus in (natural) scientific practice, emphasising that the researcher is a participant rather than a spectator. The experiments allow the conclusion that observation always seems to be *participant* observation (i.e. even in natural sciences), with the observer intervening in the process under investigation. While the interpretative issues around the role of the observer have yet to be fully explored in natural science, the understanding of observation as participant observation, with all its difficulties and constraints, has a long tradition in social sciences and the humanities.

In this respect, research subjects and topics of social sciences resemble quantum physics more than Newtonian physics. The smallest unit of society (depending on the theoretical perspective) is either an individual, an action or a communication, and the specific behaviour of those units cannot be described by laws of natural sciences or by explicit cause and effect. In a methodologically rigorous poll on preferences and practices, for instance, interviewees will respond frankly. But their answers reveal *intentions* and *interpretations* of their practice rather than what they will ultimately do or decide in a specific situation. With this, individuals (as actions or communications as smallest units of society alike) are similar to quantum particles in experiments, in which neither the observer nor the single unit itself knows how it will behave in a specific situation. Of course, statistical predictions can also be made, since the law of large numbers also applies to social phenomena. But it has long been known that this does not help to *understand* society, still less to facilitate a transformation to a low-carbon culture. Statistical analyses (of interviews, for instance) of large numbers simply do not contain information about the practice of individuals and groups in imponderable future situations.

To emphasise, this argument is not about Newtonian physics or quantum physics *qua physics*. The intention, rather, is to foster mutual understanding of the ways of conducting research in natural sciences on the one side and in social sciences/humanities on the other, using the two branches of physics as an allegory – to enable interdisciplinary cooperation. Both sides could benefit from the example in physics, where the two competing positions cannot be unified in one standardised perspective, but in each case nonetheless provide valid and viable cosmographies at different levels of complexity. As in physics, the differences between natural sciences and social sciences/humanities cannot be bridged easily. We also could learn from physics that *both* sides could profitably acknowledge the specifics *and* the constraints of their equal and opposite methodologies.

Both natural sciences and social sciences/humanities offer valid and useful contributions to climate change research. However, *social scientists* must seek a stronger voice. Among the social scientists attending this year's German IPCC annual conference, there was wide support for the notion that new ways of producing knowledge[6] are needed to address the great challenges of the twenty-first century. Although the different methodologies are still subject to debate, it seems clear that knowledge production has to include elements such as 'socially distributed, application-oriented, trans-disciplinary [research which is] subject to multiple accountabilities' (Nowotny et al., 2003, p. 179). With trans-disciplinary approaches, social scientists explore even muddier (and, thus, even less synthesisable and generalisable) paths of research, since the single unit of society (individual, action, communication) claims and researchers cannot retreat to the mere role as a spectator. However, in those case studies trans-disciplinary research produces valuable 'nuclei of knowledge (i.e. epistemes of particular cases) of social phenomena' (Krohn, 2008, p. 65).Social and humanities scholars should take it as an essential part of their

professional expertise to link and integrate those epistemes of particular knowledge and to compare differences and similarities, which then would contribute to a generally recognised knowledge, providing scenarios for the transformation process in particular cases. For *natural scientists*, such a methodologically innovative move would entail inclusion of the observer in their concepts and notions and acknowledging her/his role in the research process. While it has long been assumed that quantum physics only applies for microphenomena, it is gradually becoming clear that it also matters for the macro-world. Thus, we all should not regress beyond the state of knowledge we have already attained. At the end of the day, natural scientific results depend on theories in the same way as results in social sciences and humanities. These too are embedded in specific contexts and synthesising the results generates complex problems – as the tough debates prior to any IPCC assessment report show. Mutual recognition and acceptance of the differences between the various ways of doing research would be an essential step towards interdisciplinary cooperation facing the necessary transition.

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Notes

[1]For an enlightening critical view of the term ‘transformation’ see Brand (2016).

[2]By ‘IPCC standards’, Pörtner presumably means common natural scientific principles, such as objectivity, reproducibility, quantifiability, and measurability of basic units, which could be addressed as methodological naturalism.

[3]These, by the way, are all remarks which apply also to most research in ecology, biology, even parts of physics, etc., yet which are habitually ignored.

[4]According to Janich (1996), laws of nature are better termed laws drafted by natural scientists.

[5]Of course, the challenges of quantum physics are much more complex than this statement implies. But the details are not significant for my argument here.

[6]Often, using a phrase introduced by Gibbons et al. (1994), referred to as ‘Mode 2’ research.

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