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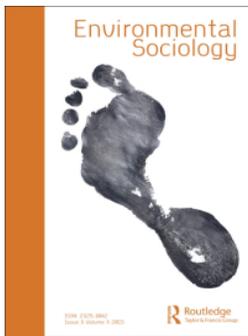
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Environmental expertise for social transformation: roles and responsibilities for social science

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ABSTRACT

What role should social science play in the work for transforming society towards sustainability? The background for this question is that despite massive investments in environmental research and the accumulation of data on the human impact on the environment, action remains insufficient. The severity of the current situation has led to the conclusion that moderate change is not enough; there is a need for a fundamental transformative change of society. How social science expertise should contribute to this is a fundamental epistemic and normative question and is the point of departure for this paper. This paper aims to develop a theory of social scientific environmental expertise. It first gives a broad account of expertise and its current landscape. It then develops a pluralistic approach, where expertise can take many forms, but should be reflexive, critical, and constructive. Finally, it stresses the crucial role that social science expertise has to play in the work for transformative change, not least to broaden environmental problems and their complexities, so that society is better equipped to undergo sustainable transformation.

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A call for social transformation

Environmental actors, including researchers, argue that urgent action is needed to prevent the breakdown of planetary systems from catastrophic climate change to biodiversity loss, over-extraction of resources and ocean acidification. Scientific data on the negative human impacts on the environment have led some to claim that we have surpassed planetary boundaries (Rockström and Goofney, 2021) and entered the qualitatively distinct epoch of the Anthropocene, which marks humans' fundamental alteration of the earth's geology and planetary systems (Clark and Szerszynski 2021). A recent turn in research and policy has stressed the social causes and impacts of environmental issues, giving them greater prominence in public discourse and political agendas. However, there is a significant gap between what is recognised as necessary to mitigate negative human impacts and what has been done. International expert organizations such as the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) have joined the call, long made by environmental activists, for far-reaching transformative change to limit climate change and biodiversity loss (see e.g. IPBES 2019; IPCC 2018). While a precise definition of 'transformative change' remains elusive and contested, it is understood here as systemic change that moves beyond technical fixes to reorder fundamental social values, structures and practices that contribute to environmental degradation.

Responsibility for the formulation, understanding and meaning-making of environmental problems has historically been located in natural sciences. Natural sciences have dominated the definition of environmental problems, been the main contributors of environmental knowledge and expertise, and taken principal roles within science–policy interfaces (Sörlin 2013). The relationship between natural science and environmental problems has tended to reinforce a solution-oriented logic of the environmental problem (Lövbrand et al. 2015). This is a logic that privileges quantifiable knowledge and techno-scientific fixes that either reduce undesirable variables or increase desirable ones. It is also a logic that relegates social sciences to the role of ex-post social impact assessments. It was rare that social scientists were involved in the full environmental problem process, from the conceptualisation, through the development of solutions to implementation and evaluation.

But times are changing – albeit unevenly. A gradual break has been made with the tendency to restrict the role of social science, not least through the foregrounding of human agency brought about by the rapid popularisation of the Anthropocene. Social science is now not only called upon to give advice on procedural aspects (such as how to involve stakeholders in decision-making processes and handle disagreement in a deliberative way) or on downstream issues and end-pipe solutions but also to develop knowledge on the social drivers of

environmental degradation, and possible ways forward. There is a growing realisation that avoiding environmental crises requires not only scientific and technological advances but also profound, enduring and just social and cultural changes, which has in turn underscored requests for social scientific expertise (Lahsen and Turnhout 2021).

Nevertheless, social scientists remain a minority within international environmental expert organisations. The need and value of engaging researchers from the social sciences and humanities has been acknowledged inside and outside expert organisations (Beck and Mahony 2018; Corbera et al. 2016), but it remains a challenge to enrol them (Hughes and Patersen 2017; Stenseke and Larigauderie 2018; Vadrot et al. 2018).¹ Given the rising demand for social science at the science/policy interface and increasing talk of the diversity of international expert organisations extending to disciplinary and epistemic diversity (Standing and Lidskog 2021), it is likely that substantial institutional changes will be made in how social scientists are recruited and integrated into expert organisations. It is, therefore, vital to reflect on both the opportunities and implications that increased demand for and relevance of social science offers for environmental problems and the work towards transformative change. The point of departure for this paper is the need for reflection on the role of social science, how guidance and advice for social change can or should be developed, and how scientific identity and epistemic authority are likely to be affected.

The following section introduces expertise in general and environmental expertise in particular. It argues that environmental expertise and environmental problems are co-constituted and that the decision to exclude certain problematisations/expertise makes their formulation inherently political. The third section turns to social science expertise, and to the question of what roles it should have within environmental problems. It argues for a pluralistic social scientific expertise geared for transformative change that embraces different perspectives and approaches but which nevertheless is reflexive, critical, and constructive. The concluding section stresses that social science environmental expertise has a crucial role to play in the work for transformative change, not least to broaden environmental problems and their complexities, so that society is better equipped to undergo sustainable transformation.

Environmental expertise: contemporary concepts and practices

What is expertise?

As societies have become more complex, exhibiting both greater interconnectivity and increased diversification of human tasks, expertise has become ever more important in ordering, structuring and controlling

societies. The increased relevance of expertise in societies has been accompanied by increased (social) scientific interest, such as in Science and Technology Studies (STS) and International Relations (IR), in what constitutes experts and expertise, and how societies produce and are produced by expert knowledge and advice. One important debate within this literature concerns the essential components of expertise, particularly specialised knowledge, and social recognition and attribution.

The substantive view stresses that expertise is characterised by the possession of specialised knowledge, acquired through extensive training (Collins and Evans 2007). An expert can thus perform a role that a non-expert cannot. Stated simply, the epistemic authority of expertise is located less with what people and groups believe about an expert, than with the knowledge, skills and experience that an expert possesses. By stressing that the epistemic content of expertise is a property of a collective (i.e., specialised knowledge), it is possible to draw a clear line between experts and non-experts. From this, it follows that experts have a special role to play above and beyond elected officials and mechanisms of democratic decision-making (Collins et al. 2020). This view does, however, come with a caveat. Despite their privileged possession of specialised knowledge, experts cannot always be correct – ‘rightness or efficaciousness’ is not sufficient criteria for evaluating whether or not someone is an expert.

The relational view stresses that expertise is not something that a person, group, or community possess unto themselves but is a quality or status that is recognised by others. To become an expert requires social negotiations and boundary work, which means that communities are not able to determine that they themselves hold expert knowledge but are beholden to the judgment of external individuals and groups (Gieryn 1999; Latour 1987). It is the strategies that a community develops and the recognition that it receives from others that constitutes its position, status and authority as expert. The credibility of beliefs is determined by the social networks that produce and sustain them. By stressing that the social content of expertise is an attribution of a collective (i.e., outcome of negotiations), the line between expert and non-expert is more fluid and variable, prompting a push to radically democratise expertise or even to rethink the formation of scientific practices as an evolving set of public rules and recognitions akin to judicial norms (Jasanoff 2006).

While the principal advocates for these views frame them as being in opposition or competition to one another (Collins and Evans 2007; Jasanoff 2003; Wynne 2003), we find that both substantive and relational elements are necessary for properly understanding the social relevance and reproduction of expertise. Expertise is about skills and competence

that are recognised and requested in society. It is a social position that provides authority and is based upon a competence recognised and trusted by peers (internal credibility) and by those requesting expert advice (external credibility) (Lidskog and Sundqvist 2018). To see expertise as a social position means that it is contextual; relevance and trustworthiness are context dependent. For example, in some settings indigenous knowledge is seen as expert knowledge, while in other settings it is seen as a system of beliefs or values.

This conceptualisation of expertise broadens its boundaries beyond science and research towards more open systems of knowledge production that socially distribute expertise (Nowotny, Scott, and Gibbons 2001). Indeed, within the environmental field, there have been increased calls for extra-scientific expertise, typically in the form of professional knowledge (Lidskog and Löfmarck 2015), citizen science (Hecker et al. 2018), local knowledges (Hill et al. 2020) and indigenous knowledges (Díaz et al. 2018). The discussion that follows focuses on scientific expertise, and more specifically the role and position of social scientific expertise.

What is environmental?

'The environmental' has shifted from being an object or phenomenon principally of the natural and physical sciences to being an object that many disciplines now study. A number of research fields have developed environmental subdisciplines, such as environmental sociology, environmental psychology, environmental anthropology, ecological economics, and green political theory. The recognition of climate change as an anthropogenic problem developed from scientific experts able to combine observations and models to show that increases in greenhouse gases in the atmosphere led to rising global temperatures (Edwards 2010). The problem has increased in complexity, in part due to the contribution of different fields of knowledge, to encompass impacts on ecosystems, economic incentives and social vulnerability. The relationship between fields of knowledge or expertise and their objects of study is not simple or linear but dynamic and contingent.

The question of which came first, the problem or the expert that describes it, is as much the work of science philosophy as it is science history (Shapin and Schaffer 2011). In contrast to the view in which experts describe external and independent phenomena, a co-productive view sees the issue and the expert emerging simultaneously. Thus, it is through practices and measures that an environmental problem is discovered, defined and understood to be a problem (Callon 1980). There is no knowledge in

advance of what a problem is or could be; as Callon (1986) has shown, problematisation precedes problems. Something had to become a problem to become amenable to a solution. Thus, environmental expertise and environmental problems are co-produced; they configure each other, leading to a circulation and stabilisation between knowledge and problem.

There are long-standing debates within the environmental social sciences concerning the conceptual meaning of nature and how social sciences should relate to natural scientific analysis of the environmental situation (Barry 2006; White, Rudy, and Gareau 2016). In recent years, there has been a move away from polarised debates around dualistic notions of 'the natural' versus 'the social' or 'the material' versus 'the discursive' to more relational and processual ontologies. For Jasanoff (2004), nature and society are co-productive of one another and cannot be understood as fully distinct categories of meaning. Latour (2005) takes this further, arguing for nature and society as the outcomes of more fundamental relations and processes. We do not have a science of environmental objects and a politics of human subjects – a world of mute nature and speaking humans (Latour 2004). It is misleading to conceptualise reality as divided into an external world of things and facts, on the one hand, and an internal world of definitions and meanings, on the other. Instead of drawing borders between nature and culture, things and humans, material and social, real and constructed, we have social networks and practices that draw together seemingly different entities (Latour 2004). It is the dynamic interplay between things, actors and groups that constitutes social, natural and scientific reality.

This discussion is not restricted to social science but also takes place within natural sciences. The broad understanding of the problem of the environmental, captured by the concept of the Anthropocene, can be grounded in a relational ontology where society and nature are co-constructed. It is no longer earth system processes alone that determine or restrict human life – humans have become co-producers of the conditions of possibility for life on earth (Clark and Szerszynski 2021; Zalasiewicz et al. 2010). The realization that social processes influence ecological processes opens environmental expertise to new meanings and practices, interdisciplinary collaboration, and post-disciplinarity (Lidskog and Waterton 2016).

The co-productive relation between the environmental, environmental problems and environmental expertise is dynamic, but may be sedimented within institutional structures that resist change. Disciplinary and social practices also reproduce – or else challenge and transform – the current configuration, closing-down opportunities for renewed problematisation

and maintaining the present authority of environmental expertise. The practices of dominance and exclusion that are inherent to this demonstrate that the configuration of environmental problems and experts is necessarily political.

The politics of expertise

Epistemic authority – a social position to speak authoritatively within a domain – results from boundary work whereby expert groups carve out and control a particular knowledge area, asserting themselves as the dominant provider of relevant knowledge within the domain (Gieryn 1999). Much boundary work takes the form of ‘expulsion’ (ibid: 15), where certain knowledge is privileged, while other knowledge is disregarded or depreciated, affecting not only the conditions of knowledge production but also the content and the circulation of knowledge in society (Pestre 2003). A crucial question is therefore: whose knowledge is awarded social legitimacy and why?

The centrality of natural and physical sciences to the configuration of environmental problems and expertise limits investigations of the social consequences of disasters and the social constraints of proposed solutions. At the same time, changes in environmental conditions, scientific discoveries, public pressure and shifts in policy may provide opportunities for new directions in research and the inclusion of different disciplines in a particular environmental problem area. Climate change provides one such example as, since the 1990s and building on their wider social relevance, economists have had an increased impact on the development of international climate policies, including in the development of policy instruments (such as carbon taxes and emissions trading), and framing of the climate as a problem of incentive structures and market mechanisms. An opening for new expertise can be quickly closed, as the opportunity to think differently is met by existing dominant social practices such as marketisation and the proliferation of economic logics (Bacevic 2021).

Even if new expertise is requested and welcomed to a field, the opportunity structure for including it may be restricted. This is the case for the IPCC, which has developed an epistemic infrastructure for global assessments, recruiting scientists to conduct these assessments and performing stage management to achieve and maintain internal and external credibility. This kind of institutionalisation – or ‘institutional epistemology’ (Borie et al. 2021) – is important for the stabilisation and circulation of knowledge in society but restricts opportunities for new expertise. In this sense, expert bodies such as the IPCC function as machinery not only for expert advice but also for shaping and reproducing expertise (Lidskog and Standing 2020). Re-problematisation in the face of stabilised and

established expertise is difficult and may lead to the exclusion of contesting experts, either involuntarily, through the initiative of dominant social groups, or voluntarily, when contestation is felt to be too marginalised. This can lead to a withdrawal from the terrain of expertise or to the establishment of a competing expert authority.

As environmental problems have become more politicised, environmental expertise has become increasingly woven with governance at both the international and national levels. Similarly, calls for policymakers have led to the emergence of policy-relevant and solution-orientated research (Eyal 2019). Accepting the invitation to take part in reconfiguring societies heavily affects the character of scientific expertise. Aware of the risks involved, scholars have suggested different ways for experts to regulate themselves and their roles in order to minimise the ‘politicisation’ of expertise (Pielke 2007), and expert bodies such as the IPCC strive to draw a clear line between science and policy, claiming that their reports are ‘neutral, policy-relevant but not policy-prescriptive’ (IPCC 2021). While these strategies require maintaining a sharp distinction of meaning between science/expertise on the one hand and politics on the other, they also obscure that relationship. As social science develops in prominence and relevance as an environmental expertise, it must reflect on the roles, practices and implications of this context.

Social scientific environmental expertise

The landscape of expertise – from the positions it is possible to take, to their respective roles and responsibilities within the science-policy interface – is complex, varied and dynamic. Social science can provide diverse expert advice, from advising how to implement policies to critiquing prominent definitions and facilitating new socio-technical imaginaries and possibilities. For some social scientists, the role of the social scientist should be to inform policymakers about options. Pielke’s (2007) ‘the honest knowledge broker’ is an example of this, where the experts should describe all options for decision-makers without recommendation. Likewise, Flyvbjerg’s (2001, 167) practical rationality, where social science should contribute to elucidating where we are, where we want to go, and what is desirable according to diverse sets of values and interests. For others, social science expertise should contribute by developing broader definitions of environmental issues, such as Raworth (2017) and her donut model, where planetary boundaries are complemented by social ones, or Jasanoff (2007) and Wynne’s (2005) stress on the need for other framings of environmental issues than the current technocratic ones. Another role for social science is to deliver new framings and alternative visions for society (Jasanoff

and Kim 2015) and to facilitate social and political experimentation to help bring visions about (Castree, Belamy, and Osaka 2021).

In each of these cases, the approach is both legitimate and possible, but each involve different implications for social scientific environmental expertise. Rather than prescribing one position for all social scientists to take, we instead argue for a pluralistic and mindful approach. Irrespective of which role is taken, we identify and develop three crucial responsibilities for social scientific expertise: to be reflexive, to be critical and to be constructive.

Reflexive expertise

Reflexive scientisation – where science is self-critical, reflecting on its own epistemic assumptions, normative commitments and social embeddedness – has long been seen as both necessary and desirable for the continued ability of science to address social problems in effective and legitimate ways (Beck 1992). STS scholars have found that scientific expertise is often unreflexive towards its own activities and underlying assumptions (Wynne 2005). When experts express a great belief in their own capacity to find correct and true answers to social problems, they often deny other actors' (not least the public's) concerns and evaluations (Irwin and Wynne 2004). While empirical evidence highlights the difficulty of achieving rigorous and continuous reflexivity (Boström, Lidskog, and Ugglå 2017), there are indications that global environmental expert organisations are moving in this direction. The following example illustrates this shift while also drawing these difficulties into focus.

The models and methods that guide IPBES assessments, particularly with respect to its engagement with indigenous and local knowledge (ILK), have been brought about through a slow, iterative process of engagement, innovation and review (Esguerra, Beck, and Lidskog 2017). Between the governing and scientific arms of the organisation, significant epistemic and methodological challenges are addressed by specialised task forces. While the mandate of these groups is set by the IPBES Bureau and Multidisciplinary Expert Panel, this has been done in consultation with third-party stakeholders, including representatives from indigenous communities.² In the case of the Task Force on ILK, a series of internal discussions and struggles against their mandate culminated in a proposal for a participatory mechanism aimed at ensuring the full inclusion of indigenous persons within the assessments (Díaz-Reviriego, Turnhout, and Beck 2019). A subsequent external review of IPBES (Stevance et al. 2020) found that the organisation had not done enough to implement the participatory mechanism. This is not to say, however,

that IPBES have completely failed to include ILK. Individuals within the organisation have developed, trialled and championed conceptual and methodological tools for identifying, verifying and syncretising ILK, and have reflected on their experiences in the scientific literature (e.g., Hill et al. 2020; McElwee et al. 2020). These publications are considered an important mechanism by which the organisation can improve. Furthermore, indigenous dialogues, staged with assistance from partner organisations, such as SwedBio, are now an established way in which IPBES scopes its work, reviews its draft assessments and verifies its findings with indigenous persons (Tengö et al. 2017). While these forms of reflexivity are sporadic and often informal, they nevertheless play a crucial role in shaping the organisation and the kinds of expertise that it produces.

While not absent from discussions within IPBES, one important theoretical dynamic in the formation of environmental expertise has yet to be tackled. Environmental expertise concerns the society-nature dynamic – including how environments are governed and shaped by social forces – but remains dominated by ecological, technical and economic sciences, and ontological approaches that separate the natural and the social. While it is essential to incorporate disciplines that emphasise the social character of environmental problems, this needs to be done without reproducing a division of labour in which some disciplines have a monopoly on understanding nature and others in society. This means that environmental experts need to take a more modest and humble position, confident of providing relevant knowledge but at the same time recognising that this knowledge is socially embedded, contingent, and contextual. To stress the contextual character of knowledge, does not mean adopting a relativistic position where all knowledge claims have equal value and validity, but implies the need to articulate the epistemic assumptions and normative commitments behind a particular understanding of an environmental problem, and recognise the limitations and opportunities it offers.

To take a position as an environmental expert implies the need to subject one's own beliefs, ideas, norms and concepts to ongoing, critical scrutiny. Part of this comes from recognising the limitations of our knowledge and expertise, and exercising epistemic humility in the face of wicked or intractable problems. There are significant institutional and structural constraints that dissuade experts from recognising their limitations, not least the desire for impact. Pushing society in a more sustainable direction must be done reflexively and with attention to epistemic assumptions, normative commitments and the social embeddedness of expertise.

Critical expertise

Being reflexive is a crucial but insufficient condition for social science expertise. It must also be critical as reflexivity often takes places *within* the boundaries of a setting or frame rather than *across* frames (Boström and Klintman 2008). Focusing on certain aspects of an activity simultaneously means less attention (i.e., less reflexivity) to aspects that fall outside the frame. It is not possible for any actor to deliver expert knowledge from nowhere; expert knowledge always develops in social settings and frames. But to stress reflexivity means that it is possible to reflect on framings, including one's own, thereby not only modifying how an environmental problem is understood and proposed to be solved but investigating what power relations have led to this understanding. To be critical means to put this process of problematization in focus, to denaturalise taken-for-granted understandings of environmental problems and to reveal the power relations behind them.

Environmental problems are often framed by questionable and simplistic models of nature and society (Jasanoff 2005; Wynne 2005). These framings imply a limited capacity to discover, understand, and internalise challenges that arise outside of the technical frame. Alternatively, aspects and issues that are considered too hard to understand technically are sorted as 'irrelevant' and placed outside the frame. Critical expertise does not presume the removal of oneself from the frame prior to critique, but rather that reflexivity and criticality imply an awareness of the naturalisations – the taken-for-granted, common-sense assumptions – of the frame of environmental problems, and the way that this occludes and excludes different perspectives and possibilities. Given that expertise is socially embedded, the social sciences have an important role to play in denaturalising the frames of environmental problems, uncovering implicit beliefs about how society works and is transformed and allowing for diverse ways of seeing and thinking about the world.

Once again, IPBES offers an instructive example. One of the principal bodies of theory and epistemic practice around which IPBES revolves is ecosystem services. While by no means singular and unchanging, ecosystem services have been characterised in terms of the concepts and models by which it engages environmental change as an economic problem with economic solutions (Lockie 2013). This approach has, over the past 20 years, become well established in the Global North, especially in Europe. Given that it regards nature as a kind of capital, and natural processes mainly in terms of their market value, it should come as little surprise that indigenous persons and many nations of the Global South objected to the influence of ecosystem services within IPBES, on the grounds

that it commodifies nature and extends capitalist and colonial interests within their territories (Masood 2018). This was not a one-off critique, but a topic returned to again-and-again, to the extent that it troubled the diversity agenda of IPBES and prompted an organisational response. In a publication in *Science* (Díaz et al. 2018), key actors addressed the shortcomings of ecosystem services and signalled an organisation-wide shift to the concept of Nature's Contributions to People (NCP). Their critique responded to assumptions and power dynamics believed to be latent to ecosystem services in favour of historically marginalised perspectives on the relationships between people and the worlds they inhabit – even at the cost of a set of well-known and politically influential terms. It is important to stress, however, that not everyone responded to the NCP turn favourably (see Faith 2018 for a summary). The dislocations that the reconceptualisation evinced and exacerbated demonstrate that critique within expert organisations is tenuous and that the surfacing of assumptions can bring about unease and anxiety.

The critical viewpoint is essential when environmental challenges are tackled at the global scale, as it helps to avoid totalising and universalising visions that obscure geographical and social diversity and the uneven distribution of environmental harms. Climate change, for example, impacts everywhere and everybody but not uniformly (Hulme et al. 2020). Erasure of spatial difference is also an erasure of social difference, and a focus on the need for change in human behaviour often elides these differences. Critical expertise is expertise that acknowledges spatial and social difference, is sensitive to their causes, and allows marginalized voices to reveal the power relations that underpin them.

In the work for transformative change, apprehending possible global futures is crucial – both to signal the urgent need for society to change and to give directions on where to go. Social science is necessary to investigate how actors construct and promote expectations about the (global) future. Efforts to address environmental issues with techno-scientific fixes originate, in part, from a solution-oriented epistemology and a drive to control nature, which leads to the obscuring of other possible futures (Scoones and Stirling 2020, 2).

The IPCC's 1.5 degree report provides an example of the importance of these spatial and temporal dynamics. The report, commissioned at the COP21 climate conference in Paris in 2015, intends to present the environmental, social and economic consequences of surpassing the climate target of 1.5 degrees above the industrial average, and four pathways for avoiding such a rise (IPCC 2018). These pathways involve portfolios of mitigation measures, highlight implementation challenges, and the potential synergies and trade-

offs of sustainable development. All pathways present the use of negative emission technologies, such as carbon capture and storage from biomass combustion, as integral to achieving emissions targets. The report downplays that these technologies are at an early stage of development and have not been tested on a large scale, and presents them without considering the far-reaching socio-spatial implications that they pose for land use (Beck and Mahony 2018; Stevenson 2021). Furthermore, the report does not question the need for (continued) economic growth but instead emphasises that growth will be decoupled from energy demand and CO₂-emissions.

There remains a significant gap between the demands made for transformative change in the report, and its practical belief and attention granted to technical solutions.

Any proposal for change should be grounded in a broad analysis of the context of the problem and be presented in a reflexive way that makes explicit its normative commitments and epistemic assumptions, thereby pluralising the space of expertise. Significant advances have been made over the last thirty years in the natural and social sciences by advancing epistemic and methodological critiques that seek to pluralise knowledge production (e.g., Coliva and Pedersen 2017). One manifestation of this is the incorporation of ILK into IPBES assessments, which encourages different kinds of problematisations and proposals for what to do – despite ongoing social and institutional contention regarding the importance of ILK's contribution to environmental expertise (Löfmarck and Lidskog 2017).

Raising critical questions about how visions of development come to be regarded as necessary, desirable, or realistic, is crucial – including questions about whose voices and interests are centred or marginalised in the process. The critique that the social sciences offer should, therefore, be applied to the very notion that science, as commonly conceived, should be the sole (or even principal) contributor and mediator of environmental knowledge for transformative change. It is not sufficient for social science to join natural science in the driving seat if it were to simply reproduce the dualistic view of policy intervention that has so far failed to produce substantive change (Plumwood 2003). Social scientists should be acutely aware of the institutional power relations – including the inequalities and exploitations – that structure not just the quality of knowledge produced but the extent and forms that knowledge takes (Bacevic 2021). It also cannot forget that its critique is an entry into an arena of contestation and debate, where expertise is inevitably also a claim to authority. Nevertheless, social scientific expertise is well equipped, in epistemological, theoretical, and methodological terms, to tackle environmental challenges, extend a critique of existing

institutional and infrastructural relations, and negotiate a range of voices, experiences and knowledges to environmental issues.

Transformations are only partially possible to govern. Critique cannot be remote from the work for transformative change nor opposed to all efforts to achieve it but instead must be fundamental to its unfolding process. Any attempts to change society and to understand the relations between society and the environment demand a critical analysis of society, and how science defines environmental problems and designs responses to them. The adoption of a critical perspective in social scientific expertise is essential to transcend simple analyses of environmental problems and move towards a critique that assembles possible ways forward.

Constructive expertise

Revealing the implicit framings and critically investigating the proposed environmental solutions are necessary but do not exhaust the responsibilities for social scientific and environmental expertise. As stressed above, there is also a need to open up to multiple voices and views of what constitutes a desirable future. Critique, in its most fundamental sense, envisages that there is something wrong with the present composition of social and political life, that something could be otherwise and that interventions could be made towards those ends (Rosa 2015, 83). In the words of Latour (2003), critique should not just be iconoclastic (i.e. aimed to tear down and destruct) but generative (i.e., to construct and invent). Social science expertise should not only be reflexive and critical but also constructive; helping and facilitating others to voice their concern and visions for the future, but also developing its own visions. This means that social scientific expertise should not be restricted to addressing predefined problems but should bring new perspectives to problematisations and the fields of possibilities inherent to them.

Social scientific expertise has an important contribution to make by shifting the empirical and normative focus of change away from narrow, hierarchical and linear notions of control over nature, towards a more reflexive, inclusive and indeterminate notion of social transformation. Much of the modern period can be characterised by human attempts to exert ever greater and more sophisticated control over their environment. Making the world controllable can, according to Rosa (2020, 15–16) be divided along four dimensions: 'first, making it visible ... making it physically reachable or accessible ... making it manageable ... making it useful'. Social scientific expertise must be wary of this allure to control nature through quick fixes. While scientists, both natural and social, have developed methods to tackle ignorance,

uncertainty and unknowns – from adaptive modelling to experimental practices – these are often situated within the very same paradigm that strives for control rather than acknowledges and embraces uncertainty. But social scientists have approaches, epistemologies and theories that move from a paradigm of control towards a paradigm of change that is more responsive to ‘plural, partial and situated knowledges’ (Scoones and Stirling 2020, 11) and more likely to result in practical, sustainable and legitimate change. This is not a retreat from the ambition to initiate and govern transformation but a recognition that society and nature cannot be fully controlled, the future cannot not be fully determined and possibilities should not be foreclosed.

Global environmental challenges are often formulated in a way that fit existing social orders and are in this sense conservative, leading to solutions that fail to address fundamental social power structures. Interdisciplinary environmental research is particularly susceptible to this conservatism – being demanded by policymakers but constrained, first, by the nature/society dualism that gives primacy to natural scientific analysis, and, second, by a solution-oriented perspective of techno-scientific fixes that reproduce rather than transcend current understanding (Barry and Born 2013). The environment is thereby presented as a given (and expanding) set of environmental problems that demand to be solved through control of the (externalised) natural environment. But as Plumwood (2003, 7) points out, such technical fixes not only carry their own risks but can stretch ecological limits and destroy nature more efficiently. The belief in technical fixes – most recently articulated by Bill Gates (2021) and the IPCC (2018) with their stress on Carbon Dioxide Removal – where the role of society is foremost to facilitate technical innovation, is attractive for many because environmental challenges are framed as not only controllable but also solvable without deeper social and cultural change. As noted above, the IPCC’s 1.5 degree report shows the necessity and possibility of limiting global temperature through a succession of technical advances, from energy transitions to developments in land use, urban planning and CO₂ removal technology. Studies have shown, however, that blind belief in technological innovations is naïve, both in terms of the speed and effectiveness of technical development, and in terms of political viability (Beck and Mahoney 2018; Hansson et al. 2021).

The need for transformative change can only be met by proposals that are more realistic, not only in terms of what is technically possible but also in terms of what is socially and politically viable. It is important that we do not lose sight of the very different ways in which people are impacted by global environmental change, the myriad local and regional issues that

remain important despite their less extensive spatial reach, and the diversity of knowledge and experiences that people draw on when framing environmental issues.

But it is also important to not end there, in a political paralysis where no transformation is possible because the world is too complex. What we instead put forward is a constructive expertise, legitimised by its epistemic content and social recognition, that neither subordinates its advice-giving to predefined problems and solutions nor only criticises every proposal. Such an expertise dares to propose other ways to conceptualise problems, discusses which futures are possible and desirable and how to best reach them and integrates normative beliefs and values into its analysis rather than obscuring or ignoring them. There is a need not only for new framings but also for social and political experimentation (Castree, Bellamy, and Osaka 2021). The challenge is to be constructive while simultaneously being reflexive and critical – and this in a time when urgent action is needed. There is a failure in acting too quickly – or too rashly – and not reflecting on the assumptions behind proposed measures. But equally, it would be a failure to not act at all, because action as well as non-action have substantial consequences. If society does not respond to the global challenges adequately, global inequalities will continue to rise and the effects of climate change and biodiversity loss will be all the more devastating.

Concluding remarks

This article articulates a fundamental position for social scientific expertise for transformative change. Expertise needs to be competent and recognised, in that it needs both to make qualified analyses of problems and to be recognised as competent and requested by a wider social group than its immediate community. Expertise is a complex practice that must negotiate a social landscape with conflicting interests and divergent beliefs about what knowledge is and how the world is constituted. Our claim is that expertise should not only provide advice on what to do but do so in a reflexive, critical and constructive way. In a time when the social sciences are increasingly requested by policymakers to make a greater contribution towards transformative change, is this suggestion productive or useful, or does it make this task even more complicated?

The point to stress here is that without a reflexive, critical and constructive approach social scientific expertise risks building its foundations on sand – providing advice that looks good, relevant and viable on paper but whose implementation will be at best partial or undermined by unintended consequences and at worst impossible. There is also a real danger that social

scientific expertise is called to help to implement technical fixes that in practice function to hinder or delay necessary social transformations. The great trust put in technologies for Carbon Dioxide Removal, which has prompted huge public and private investment, functions to a large extent to legitimate continued use of fossil fuels. In this situation, there is a need for an expertise that can critically evaluate the potential consequences of different proposals both in the functional terms of their immediate environmental impacts and the subsequent socio-political possibilities they open or obscure.

From a social science perspective, there are good reasons to be critical of taking existing (political or natural scientific) formulations of environmental problems as a point of departure. Not least that the very notion of a 'problem' guides thinking towards the possibility that there may be, or should be, a well-defined solution. Even when problems are defined as 'wicked', they remain fixed within a language and understanding linked inextricably with solutions. The reduction of climate change to 'a problem' may hide its social, spatial and temporal differentiation, and therefore it may be more productive to conceptualise it as 'a condition' in order to not foreclose the multitude and complexity of problems (including those other than environmental) that are connected to climate change (cf. Bulkeley 2019). By seeing it as a condition, space is opened for different solutions and further questioning, i.e., the need for a pluralistic approach.

There is, therefore, an urgent need for an expertise that is aware of the difficulties of initiating, facilitating and governing transformative change that acknowledges the dangers inherent to it but nevertheless dares to give advice and guide the work towards a more sustainable future.

One further consequence of moving beyond the limits of 'problem-solution' thinking is that it lifts the constraint that these are situations or issues to be overcome. Conditions can also be seen as generative not only in terms of new ways to respond to a predefined problem but new ways to conceptualise that which is problematic. This may lead to not only to changes in knowledge production and the kind of expertise requested but also new normative orientations and value shifts, as well as new forms of governing mechanism and social ordering (cf. Beck 2015; Hulme et al. 2020). There is a need for a transformative expertise that is not restricted to developing advice for solving environmental challenges within the current social and economic order, but that is visionary and can look towards the possibility of building other social orders imbued with different institutional structures, power relations and societal values.

While this article focuses on the role of scientific expertise for transformative change, this impulse to direct change should be restrained – the risk is that expertise, drawn narrowly, is given an exaggerated or disproportionate role in directing transformation. Scientific expertise, whether natural, social or a combination of the two, should not have a monopoly on developing or implementing transformative change. Other social actors are central to this process. Even if a reflexive, critical and constructive expertise is developed which gives substantial and viable recommendations for how to transform society, it will never on its own be sufficient. Transformative change will not come about because of scientific advice, nor even because of new policies. The transformation of society is a much broader process involving a multitude of social actors, active and inactive, conscious and unaware. Social science expertise has a role in this, stressing the crucial role of expert knowledge in guiding intentional transformative change and the need not only for knowledge but action.

Notes

1. While aware that much of the argument presented in this article applies also to the humanities, being social scientists, we restrict ourselves on this occasion to discussing social science. Even if there are differences between the social sciences and humanities, there are also many overlaps and crossovers. For example, the growing and expanding field 'Environmental humanities' puts not only centres meaning and culture but also asks fundamental questions about agency (human as well as non-human) and justice and representation (see e.g., Cohen and Foote 2021). Thus, it is not easy, nor even meaningful, to draw a sharp line between environmental humanities and environmental social sciences. Not least, discussions within the framework of the Anthropocene show that contributions from the social sciences and humanities open up a delimited discourse of environmental problems to a more conceptually complex, nuanced and rich understanding of current socio-environmental conditions (Oppermann and Iovino 2017).
2. The Bureau oversee the administrative functions of IPBES and the Multidisciplinary Expert Panel (MEP) its technical and scientific functions (UNEP 2012). Task forces are nominated by member states and stakeholders, and selected by the Bureau and MEP. For an analysis of how experts are nominated and elected, please see Gustafsson and Lidskog (2018).

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