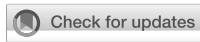


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Imagining justice: approaching justice as a process of imaginative hybridity in times of polycrisis

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In times of polycrisis, the range of interconnected risks – environmental, societal, economical, geopolitical, technological – create the milieu in which we must face these challenges as nodes within a network. No individual one can be addressed in isolation but instead must be understood as relational and operating within a unified system. Within this context, considerations of justice are increasingly referred to in relation to climate change. The system-wide changes needed in responding to the polycrisis ensures that social inequality must be understood as a central tenet across any potential or aspirational transformative change. As such, it is important to consider what justice might look like with regards to how we get there, who leads the narrative of the future, and in what fundamental ways is it different from where we currently are. We aim not to separate specific justice narratives (e.g., climate justice, energy justice) from societal justice on a broader level. Instead, within this paper, the importance of imagination in questions of justice is outlined as it is concerned with responding to climate change, and the polycrisis with which it is entangled. Climate (in)justice acts as a useful heuristic for understanding normative issues that may culminate in relation to climate change but is not operative as a specific isolated outcome or orientation. Climate justice is not a possible outcome outside of wider societal justice. Climate change represents an unprecedented challenge to the human imagination in terms of the scope and scale of the impact on the natural world; the ability to visualise the social, political and economic consequences of these changes and how changing course is envisaged. Yet, since their foundations, questions of social justice have been related to processes of imagination. Within this paper, we explore the role of imagination in shaping attitudes and responses to the climate crisis, specifically examining how imaginative processes influence perceptions of justice and ethical considerations. The primary research question guiding this study is: How do imaginative processes contribute to shaping notions of justice in relation to the climate crisis?

KEYWORDS

climate change, imaginaries, just transitions, justice, polycrisis

Introduction

In recent times, informed by the work of Edgar Morin and popularised by historian Adam Tooze, climate change has come to be understood as an aspect of the broader polycrisis (Tooze, 2022). The range of interconnected risks – environmental, societal, economic, geopolitical, technological – creates the milieu in which we must face these challenges as nodes within a network. No individual one can be addressed in isolation, but instead must be understood as relational and operating within a unified system. Within this context, considerations of justice are increasingly referred to in relation to climate change. The system-wide changes needed in responding to the polycrisis requires that social inequality must be understood as a central tenet across any potential or aspirational transformative change. The notion of sustainability refers to an expression of interconnected thinking, whereby the ‘good life’ is desired not at the expense of others, be they the Global South, lower socio-economic groups, future generations, or nature (Brocchi, 2023). Emerging from environmental justice literature, discussions of climate justice have been most consistently considered through ideal conceptions and normative arguments (Schlosberg and Collins, 2014). While such considerations hold value, it is important to consider what justice might look like with regards to how we get there, who leads the narrative of the future, and in what fundamental ways is it different from where we currently are. We aim not to separate specific justice narratives (e.g., climate justice, energy justice) from societal justice on a broader level. Instead, within this paper, the importance of imagination in questions of justice is outlined as it is concerned with responding to climate change, and the polycrisis with which it is entangled. Climate (in)justice acts as a useful heuristic for understanding normative issues that may culminate in relation to climate change, but is not operative as a specific isolated outcome or orientation. Climate justice is not a possible outcome outside of wider societal justice.

From a philosophical perspective, the human faculty of imagination has been an object of fascination, standing at the intersection of ‘perception, understanding and action’ and having the capacity to relate past, present and future (Davison, 2017). Sociological imagination is a term used to describe a framework for understanding social reality. Mills (1959, p. 5), who coined the expression, described it as ‘the awareness of the relationship between personal experience and the wider society.’ Social Imaginaries (often implicit) comprise the shared values, beliefs and understandings that form the context for how people view their place in the world and social interactions. The power of the human imagination is its ability to see beyond the limits that appear natural and ordained in the world around us, and to push forward into the realm of other possibilities (Unger et al., 2019, p. 55).

Climate change represents an unprecedented challenge to the human imagination (Bai et al., 2016; Norgaard, 2018) in terms of the scope and scale of the impact on the natural world; the ability to visualise the social, political and economic consequences of these changes and how changing course is envisioned (Steffen et al., 2018). Yet, since their foundations, questions of social justice have been related to processes of imagination. The canonical work of John Rawls concerning social justice is inherently tied to the act of imagination. Within it, Rawls (1971) introduces the original position and the veil of ignorance. The individual is asked to imagine oneself as the designer of society behind this veil, where one’s own social status and associated considerations are not known. This thought experiment brings us to think in terms of fairness with regard to how society should function.

Even Bentham’s work (see Rosen, 2024) is to some degree tied to imagining policies and actions to ensure the greatest possible happiness towards anticipated or expected outcomes, to the greatest number of people. Within this paper, we explore the role of imagination in relation to the climate crisis, and from this, draw out considerations of imaginative processes and their value in considering justice. In our consideration of these processes, we find a point of connection in Hybrid Imagination, the cognitive process (which can be seen as an extension of sociological imagination) that leads to Imaginative Hybridity, i.e., the bringing together of heterogeneous concepts (see Jamison et al., 2011).

Imagination in a time of crisis

Rosenblum suggests that ‘the juxtaposition of risk to the planet against the backdrop of geological time is beyond our ken’, beyond imagination (Rosenblum, 2014, p. 664). German sociologist Ulrich Beck agrees, insofar as ‘the future is in many ways unknowable, and uncertainty is a basic condition of human knowledge and existence’ (Beck, 2009, p. 292). Nevertheless, people have always tried to fill by imaginative means this irrevocable uncertainty regarding the spaces of the future (Diwekar et al., 2021). Climate science is better at ‘dealing with uncertainties arising due to macro trends, such as temperature extremes and sea level rise, than understanding the effects at the local level, due to downscaling challenges...local-level effects include the impacts of land use change, water management trends and socio-political and economic processes that can increase uncertainties for local people’ (Mehta and Srivastava, 2020, p. 100). Following Wilby and Dessai, they suggest that these equate to an ‘envelope of uncertainty’ which intersects with ‘social, political, economic, cultural and scientific domains, in turn shaped by historical and socio-cultural processes’ (Wilby and Dessai, 2010, p. 3). Hulme (2009, p. 271) comments on the predictions of the scientific models while ‘our poets, visionaries and sociologists tell us the future can only be imagined or invented, certainly not predicted’. As Gough points out:

‘Uncertainty may persist in the public mind even in the face of an apparently conclusive convergence of scientific evidence. It may also, in relation to particular issues and at particular times and places, be quite expunged from public discourse by all sorts of non-scientific, unscientific and even anti-scientific nonsense. People try to make sense of, and so resolve, uncertainties that they experience in a number of different ways, including through appeals to sets of rules, to substantive outcomes or to justice’ (Gough, 2017, p. 133).

When, as academics, we are encouraged to imagine climate change, it is often at the abstract level of planetary futures (Patomäki and Steger, 2010) at a geologic scale (Harris, 2017), a socio-climatic scale (Milkoreit, 2017) or more concretely at the level of a socio-technical system (Jasanoff and Kim, 2013). Increasingly conceptualised under the rubric of the Anthropocene, historian Dipesh Chakrabarty (Chakrabarty, 2017) suggests the need to fundamentally rethink our most basic assumptions where humans have become geological agents, changing the most basic physical processes of the Earth. Roy Scranton, in *Learning to Die in the Anthropocene* (Scranton, 2015) tries to re-imagine humanism at end of civilization as a way to live in the new epoch. For others, the Anthropocene is not so much a brave new

world as a transitional phase – not heralding the end of the world, but the end of the world as we know it – a *Novacene* in which humanity becomes radically decentred (Lovelock and Appleyard, 2019). What many of these things have in common is that they represent crisis imaginaries and the ‘triple temporality of crises’ bridging historical and futuristic crisis narratives impacting on concrete choices taken in the present (Kalmbach et al., 2020, p. 274). As Sandberg (2020, p. 3) suggests, ‘when we make our scenarios for the future, we need to pay attention to how they affect people in the present’. If we are to move beyond apocalyptic crises imaginaries we need to recognise that ‘the collective imagination is a causal factor in historical development: in order for another future to become possible we must imagine that it is’ [possible]. At a regional scale, recent scholarship (Chateau et al., 2021) suggests that spatial imaginaries, a variation of the geographical imagination, are ‘constituted by and constitutive of sociotechnical imaginaries (STIs), as they encode specific imaginations of socio-spatial order’ (Chateau et al., 2021, p. 1). As such questions of space and place cannot be divorced from idealised spaces and spaces of transformation that occlude socio-ecological imaginaries, nor their socio-historical and political contexts. On the other hand, ‘sustainability is perhaps the grandest socio-technical imaginary of our time, as it projects both human and planetary futures into unlimited time’ (Beck et al., 2021, p. 143).

Crisis imaginaries can create the conditions for societal solutions (social, political, legal, administrative, technological, etc.) that might not be considered under other socio-historical conditions. The emergence of ‘innovative methods and tools are unlocking new ways to capture knowledge and empower citizens. The case of citizens’ assemblies and other democratic innovations spreading in many western countries is especially relevant, as they can open up space for everybody to exercise their right to participate in public affairs that affect all of us’ (Galende-Sánchez and Sorman, 2021, p. 11). For example, institutional innovations like the Irish Citizen’s Assembly have begun to attract international attention as examples of good practice linked to the declaratory politics of a climate and biodiversity emergency (Devaney et al., 2020; Farrell et al., 2018; Muradova et al., 2020). In an alternative, scenario, Ireland’s declaration of a climate and biodiversity ‘emergency’ in 2019 could be used as a justification for techno-managerialism on a massive scale, such as solar geoengineering or authoritarian forms of regulation. Beyond a western perspective, Rajan (2019, p. 114) argues that agency is only transferred to a political body when policy is formed and implemented through it. He outlines how public political engagement in India was increased with the ‘reintroduction of elected village councils (panchayats) in India in the early 1990s’. Taking lessons from institutional innovations in policy and governance, combining them with insights from social science and engaging in dialogue with other disciplines and knowledges may well contribute to a more productive process of co-creation (Blue, 2015; Blue and Medlock, 2014; Bolger et al., 2021). In the western tradition, the imagination has been thought of in at least three ways: first, as being inferior to other mental faculties; second, as being superior to other mental faculties; and third, as playing a mediating role between faculties (Casey, 2001, pp. 15–18). Plato is the preeminent example of the first approach, condemning the imagination – or *eikasia* – as ‘a pernicious strategy of simulation’, subordinate to belief, reasoning, science, and rational intuition (Kearney, 1998; Sepper, 2013). At the other end of the spectrum, the Romantics exalt the powers of the imagination (Engell, 1981). Johann Fichte, for example, asserted that ‘all reality is brought forth solely by imagination,’ while Baudelaire regarded it as

‘the queen of the faculties’ (Fichte and Baudelaire cited in Kearney, 1998, p. 3–4). The third approach, centred on mediation, groups together disparate thinkers, including Aristotle, Kant, Hobbes, and Husserl, who allow the imagination to play a role in synthesising the sensible and the conceptual.

A hopeful interpretation of adapting to change in a new reality stresses the need to connect across diverse backgrounds to engage our collective imaginations, noting that ‘change and uncertainty is not the end of the world as we know it, it is the beginning of shared work towards a better planet than that we now have’, beginning with ‘open conversation about how we will share the planet with each other and all life on earth’ (Carpenter et al., 2019, p. 416). This, of course, is not without its challenges. In *The Great Derangement*, Amitav Ghosh suggests that the arts and humanities along with commonsense understandings and contemporary culture more broadly, struggle to grapple with climate change since it is ‘a crisis of culture, and thus of the imagination’ (Ghosh, 2016, p. 9). Moreover, climate change itself can be framed as a more fundamental ‘failure of imagination’: a failure concerning the risks and severity, and a failure to imagine solution pathways and visions of sustainable pathways and futures (Milkoreit, 2017, p. 1), and the possibility of a more just society living in ecological balance. A similar perspective can be found in an evocation within *Beyond Technical fixes: climate solutions and the great derangement*, ‘our collective failure to implement urgent action on the basis of knowing and predicting climate change outcomes warrants our conviction that profound changes are needed in how we imagine the climate problem’ (Nightingale et al., 2019, p. 6). On the other hand, while the imaginaries of the past may well be the source of the nightmares of the present, e.g., fossil fueled, carbon-based economies, the social constellations that sustained previous innovations may well help to form the necessary social infrastructure of our future innovations. The Seeds of a Good Anthropocene Project (Pereira et al., 2019, p. 8) suggests that the emergence of a ‘good anthropocene’ will come into being – radically different, yet borne out of many elements already in existence. These ‘seeds’ will combine in unique ways to create the future.

Perhaps a more forgiving interpretation is the idea of bridging the ‘imagination gap between current capability and future possibility’ (Diamond, 2019). Imagination, in this context, refers to creative ability and resourcefulness, but is also analogous to *empathy* or understanding other points of view, returning to Rawls’ original position and the veil of ignorance. Browne, who defines ‘imagination as the uniquely human capacity to envision that which is not, and therefore the fount of all invention and innovation’, makes a similar point when he says ‘novelty stops without the power to imagine and, moreover, putting yourself in someone else’s shoes is the ultimate act of imagination’ (Browne, 2019, p. x). Continuing from this, ‘the imagination is often coextensive with our creative faculties, the seat of our ability to envision something into existence. But it is also invoked in less personal and more collective manners, often discussed as the imaginary or imaginaire, with further reference to social, economic, cultural or political imaginaries’ (Vervoort et al., 2015, p. 66). Bauman (2010) notes that ‘[i]n an age when all the grand ideas have lost credibility, fear of a phantom enemy is all the politicians have left to maintain their power’ (Bauman, 2010, p. 15). With this exists a need for collective reflexivity. Empathy, it would seem, is integral to innovation (Browne, 2019; Jamison et al., 2011). The ‘affective turn in cultural studies and humanities grounds critical inquiry in the dynamics of empathy and it enables more skillful attunement to the emotional valency of expression and communication’ (Bennett, 2019, p. 87). Bennett, along with others (Byrne et al., 2017), identifies what she

calls a ‘third space where arts, sciences and publics intersect in ways that are not constrained by established disciplines and practices’ (Bennett, 2019, p. 84).

As Sandberg (2020) suggests.

‘fixation upon a particular vision of the future, as if it is predetermined by the past, can constrain our conceivable options in the present and thus make that future inevitable. We must therefore look not only for the warning signs but also for positive signs: the things that can expand our notion of what is possible and enable us to take actions that change the course of events. Over emphasizing the threat of immanent social collapse is more likely to make us cling to the social system that exists, to make us want to preserve the status quo and the system of domination and exploitation that is causing the crisis’ (Sandberg, 2020, p. 2).

The entrapping mechanisms of fear-inducing future scenarios, heightened through sensationalised preferences of social media algorithms, have been criticised as ineffectual tools for personal engagement (O’Neill and Nicholson-Cole, 2009). Instead, our survival depends on us being able to imagine and desire a different social order. Although no small task, as an academic community we must consider means through which imaginaries and processes of imagination may present opportunities to envisage a more just and ecologically sustainable future. This inevitably includes access to democratic platforms that engage with emergent imaginaries of climate resistance and agonism (Hulme, 2009). As such we require institutions that recognise and address the polarising nature of climate change, laying the foundations for collective climate action and knowledge-making processes that are attentive to dispossession, vulnerability, marginalisation and suffering (Machin, 2013; Sovacool et al., 2019).

Methods of imagined futures, and transformation

Today, updating and adapting Charles Dickens, there are ‘great expectations’ placed upon researchers to produce socially relevant, useable knowledge and to engage with non-academic actors seeking to research ‘concrete, politically acceptable and directly implementable solutions to pressing socio-ecological problems’ (Rau et al., 2018, p. 266). The phrase ‘the method of method’ alludes to, but has no allusions to achieving here, the transdisciplinary method of the French sociologist Edgar Morin (Ajello, 2005; Montuori, 2013; Morin, 2005; Morin, 2008; Morin and Kern, 1999). Keohane, tracing the etymology of the word *method*, recalls its roots in the Greek word *hodos* which means road, path or way. He reminds us that, despite modern tendencies towards separation, theory and method cannot be divorced (Keohane, 2016). Although etymology is always useful in providing us with roots, socio-logically plausible routes to sustainability require realisable connections to both theory and practice. Meanwhile, in a now standard reference work (Denzin and Lincoln, 1998), methodology [plural] has been framed as *strategies of inquiry*, which always gives rise to deeper questions regarding objectivity and subjectivity; ways of assessing the quality of social inquiry; broader questions about the nature of human knowledge, how people make sense of their social and physical environments; and how they know what they know (Rau and Fahy, 2013).

Alternatively, Goodman and Marshall (2018, p. 1) make a distinction between methodology as the study of how we come to know things through various methods and *method* as concerning the tools we use to know things. As Rau and Fahy point out, methodological choices reflect divergent ontological and epistemological views that are often occluded and obscured behind rationalisations reflecting pragmatic, instrumental choices in the accounting for the decisions made in the research process – decisions made along the way (Rau and Fahy, 2013, p. 10).

Nostalgia, or so the quip goes, is not what it used to be. If recent scholarship on the history of futures (Potts, 2018; Schulz, 2016) is to be observed we might equally conclude that the future is no longer quite what it was in the past. Both authors trace the evolution of futures from the 20th to the 21st century and conclude that up to the 1970s the expectation was largely that the future would be better than the (then) present, emanating from a base of industrial capitalism and faith in technological progress (Potts, 2018, p. 102). Schulz points out that much of the 20th century musing on the future ‘had assumed the future to be predestined, predetermined, or at least progressing in a certain direction that would make it predictable’ (Schulz, 2016, p. 4). He cites historian Reinhart Koselleck, noting that in modernity the space of experience and the horizon of expectation became progressively dissociated. For Potts, the growth of environmental concern punctured the faith in technological progress, while industrial technology became implicated in environmental destruction new political imperatives of conservation, environmentalism, sustainability, and the questioning of economic growth gained prominence (Potts, 2018, p. 102). This however, was only one of a number of heterogeneous factors including the oil crisis of the early 1970s, the legitimisation crisis of the welfare state, the threat of nuclear destruction, and the crisis of the modernisation and development (Schulz, 2016) which culminated in the ascendance of sustainable development in the 1980s. If we consider the future in today’s world, prediction is confronted by the notion of surprise which is understood as the ‘continuous emergency of its own emergence’ linked to Ulrich Beck’s idea of the world risk society where ‘the speed and complexity of interactions blur cause and effect into one creating an escalating potential for cascading catastrophic risks and a vision of a future characterised not just by complexity but by chaos’ (Rickards et al., 2014, p. 591).

Over the last decade, the exacerbation of climate change has driven the concepts of *transition* and societal *transformation*, which has provided political imaginaries for diverse forces around the planet to think about the ontological, political and material forms of post-carbon, climate resilient futures (White and Roberts, 2019). Transition and transformation are often used interchangeably and mostly metaphorically ‘to refer to radical, non-linear and structural change in complex adaptive systems’ (Hölscher et al., 2018, p. 1). Actors play a key role in shaping transitions and transformations. The semantic shift towards transformations will arguably ‘shape pathways towards common futures by identifying what is desirable and by defining the types of knowledge that informs and supports change’ (Blythe et al., 2018, p. 1208). The term transformation is increasingly appearing in prominent sustainability policies and platforms. In addition to the UN’s SDGs and the IPCC’s most recent assessment report, transformations form one of the three pillars of the global platform Future Earth (*ibid.*, p. 1210). So much so that critics have come to regard transformation as a new critical orthodoxy which risks side-lining critical analyses (Brand, 2016). At the same time, movements in civil

society like the Greta Thunberg inspired student strikes/ Fridays for Future (Hügel and Davies, 2020) and Extinction Rebellion (XR) (Chateau et al., 2021; Devaney et al., 2020; Torney, 2020) have brought critique to the fore. Climate change in a context of societal inequality, is (and will continue to) exacerbate these injustices. Mitigation alone will not avoid a deepening of these challenges, and instead a reorientation of core principles towards society and citizens over profits is essential to any attempt to justly tackle this range of issues (Baker, 2007).

A global political discourse has coalesced around the year 2050 in climate change politics; the narratives of NGO's; and the initiatives of specific governments (Hajer and Pelzer, 2018; Urquiza et al., 2018) and beyond (TWI2050, 2020). A distinction is made between *probable* and *preferable* (desirable) futures – where probable futures (expected futures) extrapolate from current trends to identify strategies to overcome obstacles, minimise threat and maximise resource use to optimise better outcomes, e.g., the scientific reports of the IPCC. Preferable, or desirable futures, on the other hand, are epitomised by the outcome of the Rio + 20 conference: *The Future We Want* and the SDGs *Transforming our world: the 2030 Agenda for Sustainable Development* (Urquiza et al., 2018). These are often the result of politically negotiated visions and frameworks for a more democratic sustainable future. Of course, we need to be critically aware of invocations of *we* or *our* statements purporting to speak to and for the *whole of humanity* (Gough, 2017, p. 133). Probable and preferable futures, setting the agendas of transition and transformations research, are often guided by authoritative international bodies like the *Intergovernmental Panel on Climate Change* (IPCC) and *Intergovernmental Platform on Biodiversity and Ecosystem Services* (IPBES). These have, *inter-alia*, 'projected pathways to meet numerical, predefined targets such as those in the Paris Agreements and the Sustainable Development Goals' (Beck et al., 2021, p. 143).

A third category is becoming increasingly significant, namely *plausible futures* – a broader range of possible futures that focus less on the continuity of existing pathways and are more inclusive of alternative visions and ways to achieve them (Bai et al., 2016; Hajer and Pelzer, 2018). These alternative futures of course are neither mutually exclusive, nor exhaustive with the others suggested and are, in fact, always normative and porous (Bergman et al., 2017). Visions and expectations, however, are also productive: 'rather than being some latent or unintended side effect, visions and expectations are a key part of the process of technological innovation' (Bergman et al., 2017 p. 166). Imaginaries of sustainable futures 'may enable or limit the scope and spaces of political action for societal transformation, and hence either catalyse or delay the search for (alternative) transformative strategies' (Beck et al., 2021, p. 144).

Transforming futures?

Irish philosopher Richard Kearney suggests that whatever label we affix to imagination it involves 'the human power to connote absence into presence, actuality into possibility, what is into something other-than-it-is ... our ability to transform the time and space of our environment into a specifically human mode of existence' (Yusoff and Gabrys, 2011, pp. 516–7). Transformation is a way of reflecting on existing practices and imagining new ways of doing and knowing (Duncan et al., 2018), the capacity to collectively envision and meaningfully

debate realistic and desirable futures (Milkoreit, 2017). In the Anthropocene, humans and nature have evolved in an intertwined and complex system operating in a new, and in some respects unknown terrain in which the possibilities for major systemic transformations increase – not all of which are desirable (Carpenter et al., 2019). As Carpernter et al. note, transformation can be either be seen, as a consequence of societal collapse, or as the capacity to transform as an essential property of long-lasting social-ecological systems. In the case of the latter, it requires the capacity to learn with change, allow space for experimentation, deepen and scale up successful experiments and navigate transitions against thresholds. Symptoms of the uncertainty and instability are, they contend, to be seen in the searching and social experimentation that we see in various social movements which can arguably be linked to an existential anxiety about the status quo. 'The turbulent dynamics of approaching an inter-connected social-ecological threshold (a changing society in which our life-support system is increasingly fragile) is fraught with both peril and possibility ... "dancing on the volcano"' (Carpenter et al., 2019, p. 2). Others identify four key mechanisms of change: innovation, expansion, reorganisation, which they broadly categorise as descriptions of the generation and diffusion of actions (innovation and expansion) e.g., technology, ecology and practice, and more fundamental changes in governance and decision-making (reorganisation) and in the values, capacities and priorities held by different actors at multiple scales, connecting with ideas of social learning as a pathway of transformation (Few et al., 2017, p. 4).

Transformations involve systems change and because of the political nature of change are subject to contestation (Hebinck et al., 2018). In such a context imagining futures becomes a political act configuring present actions, behaviour and decision-making the sphere of the actionable, and therefore particularly acute in the realm of climate mitigation in the face of increasingly dire warnings from the scientific community (Beck et al., 2021; Yusoff and Gabrys, 2011). On the other hand, climate adaptation appears less dramatic (but no less challenging) in that, rather than being driven by images of a catastrophic future, it is located within our cultural practices and everyday life imagining a more local, personal and social action (Yusoff and Gabrys, 2011, p. 522). Literature dealing with the divergences between mitigation and adaptation, co-production and citizen engagement reproduce critical dis-junctures where mitigation relates to global responsibility with long term implications and responses (e.g., Nationally Determined Contributions) and adaptation relates to visible and local scale responses where stressors are more immediate (Galende-Sánchez and Sorman, 2021).

[A]daptation initiatives usually deal with local impacts and with ex-post responses to the effects of climate change, whereas mitigation measures deal with the root causes of emissions in an ex-ante manner, requiring fundamental shifts both in behavioural and structural terms in more international terms. As such, adaptation responses may appear closer and more tangible to communities such as the management of ecosystems; adaptation on agriculture; urban adaptation or building resilience, focusing on in situ locations' (Galende-Sánchez and Sorman, 2021, p. 6).

Norgaard (2018) suggests that while we have made significant progress in developing an ecological imagination through advances in climate science, we have made much less progress in actually changing course. Rosenblum has wisely cautioned that 'without political

imagination and hope we invite an increase in already profound anti-politics and a confidence gap that resists bold policy, denies political agency, and hollows out democracy (Rosenblum, 2014, p. 667).

Several key climate scientists including Hulme, Hansen and Schellenuber, have recognised that adequately addressing climate change means that we must overcome the predilection of modern society towards an ‘addiction to prediction’ (McGrail, 2013) opening up to the importance of the socio-cultural domain and the world of experience and everyday life. As such, ‘by holding these processes separate, the ways in which climate change is both a product of and complicit in producing political economies, cultural practices, knowledges as well as ecosystems is obscured’ (Nightingale et al., 2019, p. 2). That, however, is not an injunction to throw the baby out with the bathwater! Transformations are intrinsically linked not just to processes of societal learning, but also to changes in knowledge systems involving a reconceptualisation of how scientists both imagine and interact with broader societal knowledge and governance systems as agents of change, not simply purveyors of facts (Oberlack et al., 2019). In this sense the normative dimension comes to the fore – values need to be valued and given a value beyond reductive techno-economic metrics; ‘by placing values, normative commitments, experiential and plural ways of knowing from around the world at the centre of climate knowledge, we confront climate change with contested politics and the everyday foundations of action, rather than just data’ (Nightingale et al., 2019, p. 6).

Blythe et al., however, perceive a more fundamental problem:

‘Common across most emerging transformations discourse is the normative premise that fundamental change (i.e., via technological innovations, institutional reforms, behavioural shifts, etc.) is essential to support desirable futures. Critical questions remain, however, as to what constitutes transformative change, how the concept will mutate as it is translated from an academic concept into sets of normative actions, and how this process might influence social, political, and environmental change’ (Blythe et al., 2018, p. 1208).

They point out that the shift from theory to practice is producing ambiguities and tensions with significant implications for social, political and ecological change. They offer five latent risks in the emergent discourse of transformation as it migrates from academic debate to policy prescription. The table below paraphrases these latent risks and describes how the framework of imaginative hybridity may act as a mechanism to mitigate such risks. Transformations, informed by justice considerations, are fundamentally under threat from a number of these latent risks. The opening up of narratives of transformation to wider participation can offer hope to reach beyond imaginaries entrenched in the status quo or supplanted through media, politics, and academia in public discourse (Table 1).

Part of the challenge for academia then is to transform ‘traditional participatory processes and citizens’ role[s] from mere consultation and data gatherers [providers] to collaborators involved in pre-defined projects, up to empowered agents able to lead innovative and sustainable initiatives’ (Corsini et al., 2019, p. 323). While affirming that participation is a key normative goal in responding to climate change we acknowledge the qualification (Few et al., 2007) that when focusing on goal directed processes like mitigation, adaptation and the SDGs there is a potential tension in ‘overly managed forms of inclusion that is unlikely to satisfy either participatory

TABLE 1 Overview of how imaginative hybridity acts to mitigate latent risks in transformation.

Latent risks in transformation (after Blythe et al., 2018)	Contribution of imaginative hybridity
Displacement of responsibility from systems to individual	Emphasises collective, cross-domain strategies that distribute accountability more equitably
Sustaining business as usual	Encourages innovative, adaptive responses that go beyond incremental adjustments, thus promoting genuine transformation
Neglecting social differentiation	Integrates diverse perspectives and contexts, ensuring that vulnerability and resilience are understood in their social complexities
Discounting non-transformation and resistance	Recognises resistance and non-transformation by valuing alternatives and views that may oppose dominant narratives, thus fostering inclusivity
Ignoring power and politics	Actively incorporates these dynamics into its frameworks, ensuring that risk management does not inadvertently reinforce existing inequalities or overlook underlying power structures

or instrumental goals’ (Few et al., 2007, p. 46). A critical aspect of co-creation implied by transdisciplinary research is that ‘there is flexibility within the research process in terms of how it is framed, conducted and the meaning of what constitutes success’ (Bracken et al., 2014, p. 1299). Learning including through reflecting upon failure is an important aspect of the process (Mitchell et al., 2018). On the other hand, when viewed from the perspective of top-down, national or international processes there is an ongoing tension between enhancing the governability of sustainability transitions and their democratisation (Urquiza et al., 2018). Another part of the challenge relates to the responsibility of the social sciences ‘to examine popular transformation narratives for their sociological plausibility’ (Blüdhorn et al., 2018), that is to explore the link between transformation narratives with a sociological analysis of contemporary society to uncover plausible futures.

The concept of the sociological imagination is product of a particular historical time of transition, transformation and profound uncertainty, not unlike the times we are currently experiencing (Bauman, 2010; Raskin, 2009; Žižek, 2018). C. Wright Mills introduced the concept in the aftermath of World War II on the cusp of the Cold War, but in the process opened the explorations of the social world to connecting history and experience. The sociological imagination is defined ‘as the capacity to range from the most impersonal and remote transformations to the most intimate features of the human self – and to see the relations between the two’ (Mills, 1959 cited in Norgaard, 2018, p. 171). Imagination can therefore either limit or expand our perceived place in the world—be that as individuals, communities (Anderson, 1983), nations, or as a species (Chakrabarty,

2017). Anderson's *Imagined Communities* (Anderson, 1983), for example, provided a construct to understand the intersection between technological innovation and the capacity to imagine ourselves as something larger than our day-to-day, face-to-face interactions, i.e., nations. The challenge of climate change demands that we expand the horizons of our imagination considerably. The provocation of the Anthropocene for the social sciences involves a multilogue through new interdisciplinary and transdisciplinary formations widening the scope for analysis and explanation (Goodman and Marshall, 2018). Goodman and Marshall point out that even if climate change is experienced directly, its causes and solutions are often removed from everyday life and the capacity to act. Narratives relating to climate change have to be meaningful for local action where context needs to be seen as a point of departure rather than an obstacle to be overcome or corrected by experts (Goodman and Marshall, 2018, p. 9).

Old wine in new bottles?

Calls to integrate a sociological imagination into the climate change debate could reasonably be interpreted as simply making a disciplinary claim or contribution that has hitherto been absent or marginalised. Alternatively, it could be regarded as a return to foundational primacy of the social (Murphy, 2014; Urry, 2013). Either way, we are talking about a context that increasingly valorises the importance of interdisciplinary and transdisciplinary research (Brondizio et al., 2016) and recognises that these approaches are not mutually exclusive, rather they are intimately entangled in 'Our Common Future', (Byrne et al., 2017). An important part of Mills' sociological imagination was his critique of fetishising methodology in the social sciences, or the *methodological inhibition*, where there is already a recognition that in seeking to become a social science, sociology's embrace of positivist scientific method risked denigrating other ways of understanding the world (Jacobsen et al., 2016). Unlike early appeals for sociology to simply align with research endeavours of the natural and climate sciences (Lever-Tracy, 2008), later approaches stress the diverse ways in which social science can contribute from both disciplinary and interdisciplinary perspectives, and beyond (Fiske et al., 2018; Haarstad et al., 2018; Nagel et al., 2010). The sociological imagination, in relation to environmental sociology, has been suggested as formative of 'understanding and informing the ways in which future social and ecological relationships are assembled, contested and reassembled' as distinct from wishful thinking or utopianism (Lockie, 2015, p. 141).

Strmic-Pawl talking about a series of salons discussing climate change run by an artist notes that the 'sociological imagination filled a gap in the art world's conceptual void, and new words formed from the interaction of sociology, art, and science: climatological imagination and ecological imagination' (Strmic-Pawl, 2016, p. 105). As she points out 'we must be specialists in our fields while recognising the interconnections among disciplines but never failing to keep in mind the totality of society' (Strmic-Pawl, 2016), which to us reflects Nicolescu's maxim 'no transdisciplinarity without disciplinarity' (Byrne et al., 2017). By starting from the sociological imagination, we are not suggesting a destination or outcome. A review of a decade of scholarship on the sociology of climate change has concluded that 'climate change creates some resonance in the disciplinary core of mainstream sociology but that most sociological climate change research is undertaken and published

in inter- and transdisciplinary spaces beyond the boundaries of the discipline' (Koehrsen et al., 2020). Moreover, sociologically informed climate change research becomes visible to a much stronger degree in the inter- and transdisciplinary spaces of climate change research and climate change has the capacity to expand our sociological imagination (Koehrsen et al., 2020). Galafassi et al. (2018) see that 'imagination is an integral part of the relational experience of being in the world, a generative impulse towards new desirable ways of being in the world' (2018, p. 11). As such, 'capacities of the imagination should not be exclusive to artists, scientists or politicians, but to all those involved in the numerous responses to climate change across institutional scales and in society at large' (p. 11).

The idea that knowledge, in all its diverse forms should be mobilised, not simply to understand the world but to transform it, is a cornerstone of research on sustainability transitions (Hajer and Pelzer, 2018). Several authors working broadly in the field of sustainability transitions and climate change (Grin et al., 2010; Norgaard, 2018; Wapner and Elver, 2016) have all stressed the connection between the sociological imagination and climate change as both point of departure and as a guiding perspective. A useful typology of knowledge for our purposes, that aligns with (but is not identical to) the concepts of probable, preferable and plausible futures is the distinction between systems knowledge, target knowledge and transformation knowledge (Gaziulusoy and Ryan, 2017). Systems knowledge here generally refers to the present states of systems and understanding what needs to change. Another way of conceiving of this is to focus on 'actually existing unsustainability' (Barry, 2012). In this context, systems knowledge refers to 'traditional forms of discovery-based scientific research have been successful in understanding technological, ecological and social causes of unsustainability in systems' (Gaziulusoy and Ryan, 2017, p. S1916). Target knowledge 'generates alternative future proposals for those systems that are desirable and plausible', meanwhile transformation knowledge 'is about building the potential paths between the current -undesirable, unsustainable and future -desirable, sustainable- states of the systems that are subject to transformation'.

More recently, scholars have pointed out that the sociological imagination, far from seeking to discipline the conversation, is transgressive and transdisciplinary and cannot be contained by boundaries of its own making (Koehrsen et al., 2020; Byrne et al., 2017; Rimke, 2010; Strmic-Pawl, 2016). The increase in prominence of terms like interdisciplinary, multidisciplinary, cross-disciplinary, pluri-disciplinary transdisciplinary or post-disciplinary in contemporary debates, gives the impression that such intellectual configurations are new (Rimke, 2010). Rimke, suggests that sociology has historically, and continues to, celebrate, subvert and transgress disciplinary divides. She warns that we must never forget that insights are always partial, limited, and subject to revision so that 'present knowledge is only valid until further notice'. For her, the ethical imperative of transdisciplinarity is to 'think beyond our life expectancies' (Rimke, 2010, p. 252). We could equally talk of the geographical imagination (Gregory, 1994; Harvey, 1973; Prince, 1962) or indeed the engineering imagination (Browne, 2019). All have a common root. However, for our purposes here we find synergies and points of connection with the concept of the 'hybrid imagination' (Jamison et al., 2011).

The hybrid imagination is defined as:

'the combination of a scientific-technical problem-solving competence with an understanding of the problems that need to be solved. It is a mixing of scientific knowledge and technical skills

with what might be termed cultural empathy, that is, an interest in reflecting on the cultural implications of science and technology in general and one's own contribution as a scientist or engineer, in particular' (Jamison et al., 2011, p. 4).

The authors liken the hybrid imagination to Flyvbjerg's adaptation of Aristotle's *'phronesis'* or prudence. Aristotle identified the different types of knowledge in his *Nicomachean Ethics* as *episteme*, or theoretical-philosophical knowledge, *techne*, or practical-technical knowledge, and *phronesis*, or judgmental or ethical knowledge (Jamison et al., 2011, pp. 4–5). They suggest that this hybridity for scientists and engineers responds to *'the need to transgress disciplinary boundaries and combine non-technical skills with their scientific and technical competence in order to produce knowledge in what Gibbons and his co-authors have termed "contexts of application"'* (Gibbons et al., 1994) or to create actionable knowledge (Haarstad et al., 2018). The call to 'climate action' induces researchers to venture outside their comfort zone, but it also raises the larger challenge that *'the pragmatic relevance of knowledge cannot be assumed a priori'* (Grundmann, 2017, p. 44). There is, Grundmann argues, an inherent danger in conflating theoretical knowledge and practical knowledge:

'Several conditions must be met if knowledge is to be turned into knowledge for action. The successful application of knowledge in concrete situations for action requires that knowledge is geared towards application (often it is not); that possibilities for action exist; and that the decision-maker has appropriate latitude for action, i.e., is able to shape events. These different elements must be linked together, in order that knowledge may become practical knowledge through decisions and their implementation' (Grundmann, 2017, p. 44).

Actionable knowledge is often implicit knowledge of actors, which is made explicit and productive through a research process. Rather than 'transferred', this knowledge is *'emerging from creative interactions with others' ... dedicated to enhancing a socially relevant form of knowledge, that is, "phronesis" (practical wisdom on how to address and act on social problems in a particular context)'*. As such, actionable knowledge relates to capacity development and empowerment and is not necessarily built on scientific knowledge in the first place rather it is of a different kind, commonly emerging beyond traditional research spaces. It is within this space that considerations of justice in relation to climate change and environmental challenges be that the global south, lower socio-economic groups, future generations, or nature can be explored. A transformative research approach implies that researchers pursue practice-oriented research and create transdisciplinary spaces for working on societal questions (Wittmayer et al., 2018, pp. 7–8), within which justice in relation to climate change can be incorporated as a central concern, and the multitude of implications which this (may) entail can be explored.

Conclusion

Imagination is not external to the legitimization and ordering of science and its publics, but intrinsic to their articulation (Rommetveit and Wynne, 2017). The distinction between science as reason and everyday experience as language and communication was

consolidated in the 20th Century in the two cultures described by C. P. Snow (Kimball, 1994). While Castoriadis is credited with introducing the concept of the imaginary to social science, it was Charles Taylor's clarifications that rendered it operational and open to empirical investigation, but historically *'imagination always had to be in play to explore possible understandings of "what lies beyond" existing knowledge'* (Rommetveit and Wynne, 2017, p. 140).

In the 1970s, Castoriadis introduced the concept of the *social imaginary* as societies' ability to self-institute: *'to create and re-create institutions, norms and social relationships by first creating shared ideas and meanings about the reality of these'* (Milkoreit, 2017, p. 2). For Pesch (2019, p. 1–2), social imaginaries can be seen in the way that people imagine their social existence, how they fit together with others, how things go on between them and their fellow travellers, the expectations that are normally met, and the deeper normative notions and images which underline these expectations. The *'cultural "horizon" of people's expectations and values, born out of social experience and mediated via cultural symbols, history, and material conditions, must be the main point of reference for understanding ecological concern'* (Pigott, 2018). Castoriadis recognised that while imaginaries are functional to the operation of societies and politics, they are not determining. An imaginary therefore can be conceived of as *'an enabling but not fully explicable symbolic matrix within which people imagine and act as world making collective agents'* (Wright et al., 2013, p. 651).

Charles Taylor, in his elaboration of the modern social imaginary, pointed out that politics was not just about the rational negation of ends, but moral orientations to what could or should be (Ruppert, 2018). Questions of what a just approach to climate action may look like can be explored through this moral lens. According to Levy and Spicer *'akin to the notion of culture, Taylor describes "the way ordinary people "imagine" their social surroundings; it is carried in images, stories, and legends ... the social imaginary is that common understanding that makes possible common practices and a widely shared sense of legitimacy' (Levy and Spicer, 2013, p. 661).* In practice, social imaginaries are then a common understanding that make social practices possible and legitimate. Therefore we need to be aware that national policy imaginaries are materially and politically consequential, creating futures that are co-produced *'with certain policies, institutions and infrastructures that are framed as desirable and possible, while others are framed as undesirable or problematic'* (Birch, 2016, p. 3). Levy and Spicer, drawing on the work of Jessop on cultural political economy stress that *'social imaginaries do not just construct communities (as Anderson claims) or intellectual frameworks (as Taylor assumed), but entail strategic struggle to assemble coalitions, mobilize state projects and stabilize conjoined economic and ideational systems'* (Levy and Spicer, 2013, p. 662).

Imagination processes, such as hybrid imagination, can be used to shape and guide more just transformations. There is often a concern that the social, financial, and environmental costs of transformations disproportionately fall on those with less social and economic privilege, especially on marginalised groups, while those with greater privilege will benefit most (see, e.g., Dunphy and Lennon, 2022). At the same time transformative periods offer a window to dismantle systemic injustices by addressing root causes of inequality by building better. It is essential that justice and fairness be incorporated as core principles in any potential or aspirational transformative change. Hybrid Imagination offers a means for societies to reflect on what these core principles might mean in terms of the transformation journey (the path we will take to get to the desired transformation), the

intended destination (what the desired transformation will look like), and the deviation (how different things are from the status quo). Imaginaries can gain traction and be complemented or strengthened through acts of power, ongoing coalition building, and fostering social and technical innovation. In other words, there are a variety of ways in which they can be performed (Delina, 2018). By creating openings for new imaginaries and illustrating possibilities, academics can carve out political room for manoeuvre in ways that provide momentum for change (Harvey, 2005). That said, we need to realise that imaginaries are socially, contextually and geographically specific and as such should be explored with partners beyond the confines of universities, to broaden the imaginative scope of what is possible. Aligned to this are ideas of civic imaginaries, which allow vulnerable groups to find new ways to express their political agency and become active agents of change (Mullally et al., 2022). Equally relevant are calls for more participatory processes to feed into technological futures and which critique narrow techno-fix imaginaries and promote technological innovation based on principles of justice, agency and inclusion (Barry, 2017).

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

GM: Conceptualization, Investigation, Writing – original draft. EB: Funding acquisition, Writing – review & editing. SG: Writing – review & editing. NW: Conceptualization, Writing – review & editing. CM: Writing – review & editing. AR: Writing – review & editing. EC: Writing – review & editing. ND: Funding acquisition, Project administration, Supervision, Writing – review & editing.

References

- Ajello, A. R. (2005). Method of knowledge and the challenges of the planetary society: Edgar Morin's pedagogical proposal. *World Futures* 61, 511–533. doi: 10.1080/02604020500283126
- Anderson, B. (1983). *Imagined Communities: Reflections on the origin and spread of Nationalism*. London: Verso.
- Bai, X., van der Leeuw, S., O'Brien, K., Berkhout, F., Biermann, F., Brondizio, E. S., et al. (2016). Plausible and desirable futures in the Anthropocene: a new research agenda. *Glob. Environ. Change* 39, 351–362. doi: 10.1016/j.gloenvcha.2015.09.017
- Baker, S. (2007). Sustainable development as symbolic commitment: declaratory politics and the seductive appeal of ecological modernisation in the European Union. *Environ. Polit.* 16, 297–317. doi: 10.1080/09644010701211874
- Barry, J. (2012). *The Politics of Actually Existing Unsustainability: Human Flourishing in a Climate-Changed, carbon-Constrained World*. Oxford: Oxford University Press.
- Barry, J. (2017). "Bio-fuelling the hummer?" in *Transdisciplinary Perspectives on the transition to Sustainability*, eds. E. Byrne, G. Mullally and C. Sage (Abingdon: Routledge), 106–124.
- Bauman, Z. (2010). "Conclusion: the triple challenge," in *Bauman's challenge: Sociological Issues for the 21st Century*, eds. M. Davis and K. Tester (London: Palgrave Macmillan), 200–205.
- Beck, U. (2009). World risk society and manufactured uncertainties. *Iris. Eur. J. Philos. Pub. Debate* 1, 291–299. doi: 10.13136/ir.v1i2i8S.594
- Beck, S., Jasanoff, S., Stirling, A., and Polzin, C. (2021). The governance of sociotechnical transformations to sustainability. *Curr. Opin. Environ. Sustain.* 49, 143–152. doi: 10.1016/j.cosust.2021.04.010
- Bennett, J. (2019). Lived experience and the limits (and possibilities) of empathy. *Cult. Stud. Rev.* 25, 84–88. doi: 10.5130/csr.v25i2.6881
- Bergman, N., Schwanen, T., and Sovacool, B. K. (2017). Imagined people, behaviour and future mobility: insights from visions of electric vehicles and car clubs in the United Kingdom. *Transp. Policy* 59, 165–173. doi: 10.1016/j.tranpol.2017.07.016
- Birch, K. (2016). Emergent imaginaries and fragmented policy frameworks in the Canadian bio-economy. *Sustainability* 8:1007. doi: 10.3390/su8101007
- Blüdhorn, I., Butzlaff, F., Deflorian, M., and Hausknost, D. (2018). *Transformation Research and academic Responsibility: The social Theory gap in Narratives of radical change*. Vienna: Institute for Social Change and Sustainability.
- Blue, G. (2015). Framing climate change for public deliberation: what role for interpretive social sciences and humanities? *J. Environ. Policy Plann.* 18, 67–84. doi: 10.1080/1523908x.2015.1053107
- Blue, G., and Medlock, J. (2014). Public engagement with climate change as scientific citizenship: a case study of world wide views on global warming. *Sci. Cult.* 23, 560–579. doi: 10.1080/09505431.2014.917620
- Blythe, J., Silver, J., Evans, L., Armitage, D., Bennett, N. J., Moore, M.-L., et al. (2018). The dark side of transformation: latent risks in contemporary sustainability discourse. *Antipode* 50, 1206–1223. doi: 10.1111/anti.12405

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- Bolger, P., Brereton, P., Grant, O., and Torney, D. (2021). *Better Together: Knowledge co-Production for a Sustainable Society*. Dublin: Royal Irish Academy.
- Bracken, L. J., Bulkeley, H. A., and Whitman, G. (2014). Transdisciplinary research: understanding the stakeholder perspective. *J. Environ. Plan. Manag.* 58, 1291–1308. doi: 10.1080/09640568.2014.921596
- Brand, U. (2016). 'Transformation' as a new critical orthodoxy: the strategic use of the term 'transformation' does not prevent multiple crises. *GAEA – Ecol. Persp. Sci. Soc.* 25, 23–27. doi: 10.14512/gaia.25.1.7
- Brocchi, D. (2023). Unequal into the collapse: why there can be no sustainability without social justice. *J. Polit. Sci. Int. Relat.* 6, 99–110. doi: 10.11648/j.jpsir.20230604.11
- Brondizio, E. S., O'Brien, K., Bai, X., Biermann, F., Steffen, W., Berkhout, F., et al. (2016). Re-conceptualizing the Anthropocene: a call for collaboration. *Glob. Environ. Change* 39, 318–327. doi: 10.1016/j.gloenvcha.2016.02.006
- Browne, J. (2019). *Make, Think, Imagine: Engineering the Future of Civilisation*. London: Bloomsbury Publishing.
- Byrne, E., Mullally, G., and Sage, C. (2017). *Transdisciplinary Perspectives on Transitions to Sustainability*. Abingdon: Routledge.
- Carpenter, S. R., Folke, C., Scheffer, M., and Westley, F. R. (2019). Dancing on the volcano: social exploration in times of discontent. *Ecol. Soc.* 24:23. doi: 10.5751/ES-10839-240123
- Casey, E. S. (2001). Between geography and philosophy: what does it mean to be in the place-world? *Ann. Assoc. Am. Geogr.* 91, 683–693. doi: 10.1111/0004-5608.00266
- Chakrabarty, D. (2017). The future of the human sciences in the age of humans: a note. *Eur. J. Soc. Theory* 20, 39–43. doi: 10.1177/1368431016642780
- Chateau, Z., Devine-Wright, P., and Wills, J. (2021). Integrating sociotechnical and spatial imaginaries in researching energy futures. *Energy Res. Soc. Sci.* 80:102207. doi: 10.1016/j.erss.2021.102207
- Corsini, F., Certomà, C., Dyer, M., and Frey, M. (2019). Participatory energy: research, imaginaries and practices on people' contribute to energy systems in the smart city. *Technol. Forecast. Soc. Change* 142, 322–332. doi: 10.1016/j.techfore.2018.07.028
- Davison, A. (2017). 'Not to escape the world but to join it': responding to climate change with imagination not fantasy. *Philos. Trans. R. Soc. A Math. Phys. Eng. Sci.* 375:20160365. doi: 10.1098/rsta.2016.0365
- Delina, L. L. (2018). Whose and what futures? Navigating the contested coproduction of Thailand's energy sociotechnical imaginaries. *Energy Res. Soc. Sci.* 35, 48–56. doi: 10.1016/j.erss.2017.10.045
- Denzin, N. K., and Lincoln, Y. S. (1998). "Major paradigms and perspectives," in *Strategies of Qualitative Inquiry*, (Thousand Oaks, CA: Sage Publications, Inc.), 185–217.
- Devaney, L., Torney, D., Brereton, P., and Coleman, M. (2020). Ireland's citizens' assembly on climate change: lessons for deliberative public engagement and communication. *Environ. Commun.* 14, 141–146. doi: 10.1080/17524032.2019.1708429
- Diamond, S. (2019). Addressing the imagination gap through STEAMM+D and indigenous knowledge. *Proc. Natl. Acad. Sci.* 116, 1851–1856. doi: 10.1073/pnas.1808679115
- Diwekar, U., Amekudzi-Kennedy, A., Bakshi, B., Baumgartner, R., Boumans, R., Burger, P., et al. (2021). A perspective on the role of uncertainty in sustainability science and engineering. *Resour. Conserv. Recycl.* 164:105140. doi: 10.1016/j.resconrec.2020.105140
- Duncan, R., Robson-Williams, M., Nicholas, G., Turner, J., Smith, R., and Diprose, D. (2018). Transformation is 'experienced, not delivered': insights from grounding the discourse in practice to inform policy and theory. *Sustainability* 10:3177. doi: 10.3390/su10093177
- Dunphy, N. P., and Lennon, B. (2022). "Whose transition? A review of citizen participation in the energy system," in *Routledge Handbook of Energy Transitions*, ed. K. Araújo (Routledge), 430–444.
- Engell, J. (1981). *The Creative Imagination: Enlightenment to Romanticism*. Cambridge: Harvard University Press.
- Farrell, D. M., Suiter, J., and Harris, C. (2018). 'Systematizing' constitutional deliberation: the 2016–18 citizens' assembly in Ireland. *Ir. Polit. Stud.* 34, 113–123. doi: 10.1080/07907184.2018.1534832
- Few, R., Brown, K., and Tompkins, E. L. (2007). Public participation and climate change adaptation: avoiding the illusion of inclusion. *Clim. Pol.* 7, 46–59. doi: 10.1080/14693062.2007.9685637
- Few, R., Morchain, D., Spear, D., Mensah, A., and Bendapudi, R. (2017). Transformation, adaptation and development: relating concepts to practice. *Palgrave Commun.* 3:92. doi: 10.1057/palcomms.2017.92
- Fiske, S. J., Klaus, H., Jorgenson, A., and York, R. (2018). *Drivers and Responses: Social Science Perspectives on Climate change, Part 2*. Washington, DC: US Global Change Research Program.
- Galafassi, D., Tàbara, J. D., and Heras, M. (2018). Restoring our senses, restoring the earth. Fostering imaginative capacities through the arts for envisioning climate transformations. *Elementa Sci. Anthr.* 6:69. doi: 10.1525/elementa.330
- Galende-Sánchez, E., and Sorman, A. H. (2021). From consultation toward co-production in science and policy: a critical systematic review of participatory climate and energy initiatives. *Energy Res. Soc. Sci.* 73:101907. doi: 10.1016/j.erss.2020.101907
- Gaziulusoy, A. İ., and Ryan, C. (2017). Shifting conversations for sustainability transitions using participatory design visioning. *Des. J.* 20, S1916–S1926. doi: 10.1080/14606925.2017.1352709
- Ghosh, A. (2016). *The great Derangement: Climate change and the Unthinkable*. Chicago, IL: The University of Chicago Press.
- Gibbons, M., Limoges, C., Scott, P., Schwartzman, S., and Nowotny, H. (1994). *The new Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London: Sage Publications Ltd.
- Goodman, J., and Marshall, J. P. (2018). Problems of methodology and method in climate and energy research: socialising climate change? *Energy Res. Soc. Sci.* 45, 1–11. doi: 10.1016/j.erss.2018.08.010
- Gough, S. (2017). Education after sustainability. *Glob. Discourse* 7, 131–145. doi: 10.1080/23269995.2017.1300435
- Gregory, D. (1994). *Geographical Imaginations*. Malden, MA: Wiley-Blackwell.
- Grin, J., Rotmans, J., and Schot, J. (2010). *Transitions to Sustainable Development*. New York, NY: Routledge.
- Grundmann, R. (2017). The problem of expertise in knowledge societies. *Minerva* 55, 25–48. doi: 10.1007/s11024-016-9308-7
- Haarstad, H., Sareen, S., Wanvik, T. I., Grandin, J., Kjærås, K., Oseland, S. E., et al. (2018). Transformative social science? Modes of engagement in climate and energy solutions. *Energy Res. Soc. Sci.* 42, 193–197. doi: 10.1016/j.erss.2018.03.021
- Hajer, M. A., and Pelzer, P. (2018). 2050—an energetic odyssey: understanding 'techniques of futuring' in the transition towards renewable energy. *Energy Res. Soc. Sci.* 44, 222–231. doi: 10.1016/j.erss.2018.01.013
- Harris, D. M. (2017). Telling the story of climate change: geologic imagination, praxis, and policy. *Energy Res. Soc. Sci.* 31, 179–183. doi: 10.1016/j.erss.2017.05.027
- Harvey, D. (1973). *Social Justice and the city*. Baltimore: Johns Hopkins University Press.
- Harvey, D. (2005). The sociological and geographical imaginings. *Int. J. Politics Cult. Soc.* 18, 211–255. doi: 10.1007/s10767-006-9009-6
- Hebinck, A., Vervoort, J. M., Hebinck, P., Rutting, L., and Galli, F. (2018). Imagining transformative futures: participatory foresight for food systems change. *Ecol. Soc.* 23:216. doi: 10.5751/es-10054-230216
- Hölscher, K., Wittmayer, J. M., and Loorbach, D. (2018). Transition versus transformation: what's the difference? *Environ. Innov. Soc. Transit.* 27, 1–3. doi: 10.1016/j.eist.2017.10.007
- Hügel, S., and Davies, A. R. (2020). Public participation, engagement, and climate change adaptation: a review of the research literature. *WIREs Clim. Change* 11, 1–20. doi: 10.1002/wcc.645
- Hulme, M. (2009). *Why we Disagree about Climate change: Understanding Controversy, Inaction and Opportunity*. Cambridge: Cambridge University Press.
- Jacobsen, M. H., Drake, M. S., Keohane, K., and Petersen, A. (2016). "Introduction: imaginative methodologies, creativity, poetics and the challenges to conventional social science," in *Imaginative Methodologies in the social Sciences: Creativity, Poetics and Rhetoric in social Research*, eds. M. H. Jacobsen, M. S. Drake, K. Keohane and A. Petersen (New York, NY: Routledge), 1–22.
- Jamison, A., Christensen, S. H., and Botin, L. (2011). *A hybrid Imagination: Science and Technology in Cultural Perspective. Synthesis lectures on engineers, technology, and society*. San Rafael: Morgan & Claypool Publishers, 182–200.
- Jananoff, S., and Kim, S.-H. (2013). Sociotechnical imaginaries and national energy policies. *Sci. Cult.* 22, 189–196. doi: 10.1080/09505431.2013.786990
- Kalmbach, K., Marklund, A., and Åberg, A. (2020). Crises and technological futures: experiences, emotion, and action. *Technol. Cult.* 61, 272–281. doi: 10.1353/tech.2020.0001
- Kearney, R. (1998). *Poetics of Imagining: Modern to post-modern*. New York, NY: Fordham University Press.
- Keohane, K. (2016). "Creative methods: oracles, poesis and epiphanies as metaphors of theorizing," in *Imaginative Methodologies in the social Sciences: Creativity, Poetics and Rhetoric in social Research*, eds. M. H. Jacobsen, M. S. Drake, K. Keohane and A. Petersen (New York, NY: Routledge), 177–195.
- Kimball, R. (1994). 'The two cultures' today. *New Criterion* 22, 10–20.
- Koehrsen, J., Dickel, S., Pfister, T., Rödder, S., Bösch, S., Wendt, B., et al. (2020). Climate change in sociology: still silent or resonating? *Curr. Sociol.* 68, 738–760. doi: 10.1177/0011392120902223
- Lever-Tracy, C. (2008). Global warming and sociology. *Curr. Sociol.* 56, 445–466. doi: 10.1177/0011392107088238
- Levy, D. L., and Spicer, A. (2013). Contested imaginaries and the cultural political economy of climate change. *Organization* 20, 659–678. doi: 10.1177/1350508413489816
- Lockie, S. (2015). What is environmental sociology? *Environ. Sociol.* 1, 139–142. doi: 10.1080/23251042.2015.1066084
- Lovelock, J., and Appleyard, B. (2019). *Novacene: The Coming age of Hyperintelligence*. London: Allen Lane.
- Machin, A. (2013). *Negotiating Climate change: Radical Democracy and the Illusion of consensus*. London: Bloomsbury.
- McGrail, S. (2013). Climate change and futures epistemologies: tensions, trends and possibilities in climate discourses epitomised by three prominent climate experts. *J. Future Stud.* 17, 21–40. Available online at: <https://jfsdigital.org/wp-content/uploads/2013/10/173-A02.pdf>

- Mehta, L., and Srivastava, S. (2020). "Uncertainty in modelling climate change: the possibilities of co-production through knowledge pluralism," in *The Politics of Uncertainty: Challenges of Transformation*, eds. I. Scoones and A. Stirling (Abingdon: Routledge).
- Milkoreit, M. (2017). Imaginary politics: climate change and making the future. *Elementa Sci. Anthropolocene* 5:249. doi: 10.1525/elementa.249
- Mills, C. W. (1959). *The Sociological Imagination*. Oxford: Oxford University Press.
- Mitchell, C., Fam, D., and Cordell, D. (2018). Outcome spaces: designing for impact in transdisciplinary research. *Gaia* 27, 112–118. doi: 10.14512/gaia.27.1.3
- Montuori, A. (2013). Complex thought: an overview of Edgar Morin's intellectual journey. Sebastopol, CA MetaIntegral Foundation.
- Morin, E. (2005). RE: from prefix to paradigm. *World Futures* 61, 254–267. doi: 10.1080/02604020590952583
- Morin, E. (2008). *On Complexity*. Cresskill: Hampton Press.
- Morin, E., and Kern, A. B. (1999). *Homeland Earth: A Manifesto for the new Millenium*. Cresskill: Hampton Press.
- Mullally, G., Revez, A., Harris, C., Dunphy, N., Rogan, F., Byrne, E., et al. (2022). *A Roadmap for local Deliberative Engagements on Transitions to net zero carbon and Climate Resilience*. Wexford: Environmental Protection Agency.
- Muradova, L., Walker, H., and Colli, F. (2020). Climate change communication and public engagement in interpersonal deliberative settings: evidence from the Irish citizens' assembly. *Clim. Pol.* 20, 1322–1335. doi: 10.1080/14693062.2020.1777928
- Murphy, R. (2014). The emerging hypercarbon reality, technological and post-carbon utopias, and social innovation to low-carbon societies. *Curr. Sociol.* 63, 317–338. doi: 10.1177/0011392114551757
- Nagel, J., Dietz, T., and Broadbent, J. (2010). *Workshop on Sociological Perspectives on Global Climate change*. Washington DC: American Sociological Association.
- Nightingale, A. J., Eriksen, S., Taylor, M., Forsyth, T., Pelling, M., Newsham, A., et al. (2019). Beyond technical fixes: climate solutions and the great derangement. *Clim. Dev.* 12, 343–352. doi: 10.1080/17565529.2019.1624495
- Norgaard, K. M. (2018). The sociological imagination in a time of climate change. *Glob. Planet. Change* 163, 171–176. doi: 10.1016/j.gloplacha.2017.09.018
- O'Neill, S., and Nicholson-Cole, S. (2009). 'Fear won't do it': promoting positive engagement with climate change through visual and iconic representations. *Sci. Commun.* 30, 355–379. doi: 10.1177/1075547008329201
- Oberlack, C., Breu, T., Giger, M., Harari, N., Herweg, K., Mathez-Stiefel, S.-L., et al. (2019). Theories of change in sustainability science: understanding how change happens. *Gaia* 28, 106–111. doi: 10.14512/gaia.28.2.8
- Patomäki, H., and Steger, M. B. (2010). Social imaginaries and big history: towards a new planetary consciousness? *Futures* 42, 1056–1063. doi: 10.1016/j.futures.2010.08.004
- Pereira, L., Bennett, E., Biggs, R., Mangnus, A., Norström, A. V., Peterson, G., et al. (2019). Seeding change by visioning good Anthropocenes. *Solutions J.* 10, 1–15. Available online at: <https://thesolutionsjournal.com/seeding-change-visioning-good-anthropocenes/>
- Pesch, U. (2019). Elusive publics in energy projects: the politics of localness and energy democracy. *Energy Res. Soc. Sci.* 56:101225. doi: 10.1016/j.erss.2019.101225
- Pigott, A. (2018). Imagining socioecological transformation: an analysis of the Welsh government's policy innovations and orientations to the future. *Elementa Sci. Anthr.* 6:60. doi: 10.1525/elementa.315
- Potts, J. (2018). Futurism, futurology, future shock, climate change: visions of the future from 1909 to the present. *PORTAL: J. Multidisciplinary Int. Stu.* 15, 99–116. doi: 10.5130/portal.v15i1-2.5810
- Prince, H. C. (1962). The geographical imagination. *Landscape* 11, 22–25.
- Raskin, P. D. (2009). "Planetary praxis: on rhyming hope and history," in *The Coming transition: Values to Sustain human and natural Communities*, (New Haven, CT: Yale School of Forestry and Environment), 110–146.
- Rau, H., and Fahy, F. (2013). "Sustainability research in the social sciences: concepts, methodologies and the challenge of interdisciplinarity," in *Methods of Sustainability Research in the social Sciences*, ed. H. Rau (London: Sage Publications Ltd.), 3–24.
- Rau, H., Goggins, G., and Fahy, F. (2018). From invisibility to impact: recognising the scientific and societal relevance of interdisciplinary sustainability research. *Res. Policy* 47, 266–276. doi: 10.1016/j.respol.2017.11.005
- Rawls, J. (1971). *A Theory of Justice*. Cambridge: Harvard University Press.
- Rickards, L., Ison, R., Fünfgeld, H., and Wiseman, J. (2014). Opening and closing the future: climate change, adaptation and scenario planning. *Environ. Plann. C Gov. Policy* 32, 587–602. doi: 10.1068/c3204ed
- Rimke, H. (2010). Remembering the sociological imagination: transdisciplinarity, the genealogical method, and epistemological politics. *Int. J. Interdisciplinary Soc. Sci. Annual Rev.* 5, 239–254. doi: 10.18848/1833-1882/cgp/v05i01/59361
- Rommetveit, K., and Wynne, B. (2017). Technoscience, imagined publics and public imaginations. *Public Underst. Sci.* 26, 133–147. doi: 10.1177/0963662516663057
- Rosen, F. (2024). "The origin of liberal utilitarianism: Jeremy Bentham and liberty 1," in *Victorian Liberalism*, ed. R. Bellamy (Abingdon: Routledge), 58–70.
- Rosenblum, N. L. (2014). Governing beyond imagination: the 'world historical' sources of democratic dysfunction. *B.U. L. Rev.* 94, 649–667. Available online at: <https://www.bu.edu/bulawreview/files/2014/08/ROSENBLUMDYSFUNCTION1.pdf>
- Ruppert, E. (2018). *Sociotechnical imaginaries of different data futures: An experiment in citizen data*. Rotterdam: Erasmus University.
- Sandberg, O. M. (2020). Climate disruption, political stability, and collective imagination. *Radic. Philos. Rev.* 23, 331–360. doi: 10.5840/radphilrev2020324108
- Schlosberg, D., and Collins, L. B. (2014). From environmental to climate justice: climate change and the discourse of environmental justice. *Wiley Interdiscip. Rev. Clim. Chang.* 5, 359–374. doi: 10.1002/wcc.275
- Schulz, M. S. (2016). Debating futures: global trends, alternative visions, and public discourse. *Int. Sociol.* 31, 3–20. doi: 10.1177/0268580915612941
- Scranton, R. (2015). *Learning to die in the Anthropocene: Reflections on the end of a Civilization*. San Francisco, CA: City Lights Books.
- Sepper, D. L. (2013). *Understanding Imagination: The Reason of Images*. Dordrecht: Springer.
- Sovacool, B. K., Baker, L., Martiskainen, M., and Hook, A. (2019). Processes of elite power and low-carbon pathways: experimentation, financialisation, and dispossession. *Glob. Environ. Change* 59:101985. doi: 10.1016/j.gloenvcha.2019.101985
- Steffen, W., Rockström, J., Richardson, K., Lenton, T. M., Folke, C., Liverman, D., et al. (2018). Trajectories of the earth system in the Anthropocene. *Proc. Natl. Acad. Sci.* 115, 8252–8259. doi: 10.1073/pnas.1810141115
- Strmic-Pawl, H. V. (2016). Reply to Wright, Embrick, and Henke; and Lembcke. *Human. Soc.* 40, 104–106. doi: 10.1177/0160597615621454
- Tooze, A. (2022). *Welcome to the world of the polycrisis*. London: Financial Times.
- Torney, D. (2020). The politics of emergency? Ireland's response to climate change. *Ir. Stud. Int. Aff.* 31, 13–26. doi: 10.1353/isia.2020.0005
- TWI2050 (2020). *Innovations for Sustainability*. Laxenburg: International Institute for Applied Systems Analysis (IIASA).
- Unger, R. M., Stanley, I., Gabriel, M., and Mulgan, G. (2019). *Imagination Unleashed: Democratising the Knowledge Economy*. London: Nesta.
- Urquiza, A., Amigo, C., Billi, M., and Espinosa, P. (2018). Participatory energy transitions as boundary objects: the case of Chile's Energía2050. *Front. Energy Res.* 6:134. doi: 10.3389/fenrg.2018.00134
- Urry, J. (2013). A low carbon economy and society. *Philos. Trans. R. Soc. A Math. Phys. Eng. Sci.* 371, 20110566–20110512. doi: 10.1098/rsta.2011.0566
- Vervoort, J. M., Bendor, R., Kelliher, A., Strik, O., and Helfgott, A. E. R. (2015). Scenarios and the art of worldmaking. *Futures* 74, 62–70. doi: 10.1016/j.futures.2015.08.009
- Wapner, P., and Elver, H. eds (2016). *Reimagining Climate change*. New York, NY: Routledge.
- White, D., and Roberts, T. (2019). "Post carbon transition futuring: for a reconstructive turn in the environmental social sciences?" in *The Cambridge Handbook of Environmental Sociology*, eds. K. Legun, J. C. Keller, M. Carolan and M. M. Bell (Cambridge: Cambridge University Press).
- Wilby, R. L., and Dessai, S. (2010). Robust adaptation to climate change. *Weather* 65, 180–185. doi: 10.1002/wea.543
- Wittmayer, J., Hölscher, K., Wunder, S., and Veenhoff, S. (2018). *Transformation Research: Exploring Methods for an Emerging Research field*. Dessau-Roßlau: Umweltbundesamt.
- Wright, C., Nyberg, D., De Cock, C., and Whiteman, G. (2013). Future imaginings: organizing in response to climate change. *Organization* 20, 647–658. doi: 10.1177/1350508413489821
- Yusoff, K., and Gabrys, J. (2011). Climate change and the imagination. *Wiley Interdiscip. Rev. Clim. Chang.* 2, 516–534. doi: 10.1002/wcc.117
- Žižek, S. (2018). *Living in the end times*. London: Verso.