RESEARCH

Touring the carbon ruins: towards an ethics of speculative decarbonisation

Paul Graham Raven, paul@paulgrahamraven.com
Johannes Stripple, johannes.stripple@svet.lu.se
Lunds Universitet, Sweden

For many years, questions about the future have been marginalised within the social sciences: asking how we might live in a post-fossil society, or what are the key decisions and events that could take us there, has been seen as outside of the disciplinary scope. In this paper – which takes as its point of departure the 'speculative turn' that is increasingly inspiring a range of works, from foresight scenarios to design fiction – we insist on the need to invent methods and practices which provide speculative spaces that allow such questions to be articulated. We use our own speculative initiative, 'The Museum of Carbon Ruins', to foreground a series of ethical questions that accompany such speculative endeavours, but which have so far been neglected in contemporary discussions. Working within a critical utopian modality, Carbon Ruins does not foreclose ethical possibilities, but allows citizens to grapple with, evaluate, amend and critique the post-fossil futures that official policy is striving towards.

Key words speculative methods • critical utopia • decarbonisation • imaginaries • futures • ecomodernism

Key messages
- A pioneering and reflective examination of the ethics of speculative methods in climate policy.
- Presents utopian modes as an analytical lens to turn on sociotechnical and/or climate imaginaries.
- Explores the Museum of Carbon Ruins, a unique co-productive climate communications initiative.
- Openly fictional futures strike a fairer discursive bargain than the masked utopias of ecomodernism.

Introduction and literature review

It is striking how futurisms, utopias and dystopias abound in popular media and everyday discourses. Now that rumours of the death of history have been revealed to be greatly exaggerated, 'the future' is once again a topic of – and a site for – political contestation. Indeed, it could be argued that we are in the midst of a 'speculative turn', not just in the academic social sciences, but in Anglophone culture more broadly.

The term 'speculation' has multiple meanings; we are concerned primarily with the meaning defined as 'the activity of guessing possible answers to a question without having enough information to be certain' (Dictionary.cambridge.org, 2019).[1] This paper uses the Museum of Carbon Ruins (MCR) to think through some ethical issues that are raised when we speculate about the transition to a post-fossil society. MCR is an immersive exhibition that allows visitors to step into the future. In this world, Sweden reached its target of carbon neutrality by 2045, with the world following suit five years later; the museum opens in 2053, and looks back at the events that brought it into being. MCR displays that which has been left behind, alongside pivotal events, and people and places that came to be significant.

In general terms, the speculative question that MCR grapples with is: assuming a certain set of policies and technological transitions are successfully enacted in a certain location by a certain date in the future, what are the consequences, and how might life look and feel and mean to ordinary people living there? This is a questioning attitude common to science fiction media, but it has a far longer history, and has always – despite periods characterised by claims to the contrary – been an explicitly political form of speculation. In our first section, we will review that history of speculation, and its most recent manifestations, in a manner that positions the MCR exhibition as a culmination (or at least a continuation) of this tradition – one which attempts to learn from its earlier implementations in terms of technique as well as ethics. In the second section, we will briefly describe MCR as a speculative and performative intervention into narratives of environmental politics and sociotechnical transition. In the third section, we will interrogate the ethics of this project, and of similar speculative endeavours, from deontological, consequential and virtue-ethical perspectives.

A history of political speculations

Histories of political speculation usually start in 1551 with Thomas More's *Utopia* (More et al, 2016), which gave us the generic label still applied to such imaginative exercises. Perhaps more importantly, however, More's book marks the emergence of a new humanist form of futurity which 'breaks with eschatology, with millenarianism and even with the myths of the inversion of the socio-religious order of the Middle Ages', and which 'partakes of a conception of time whose every feature is changing at about the same period … a time that is henceforth considered absolutely irreversible'

– a futurity whose teleology is no longer defined by the eschatologies of scripture, but rather by more mundane notions of progress, profit and power (Schmitt, 2000: 16–17). More's *Utopia*, then, marks a moment in which futurity became open to the human imagination in a way that it had not been previously, at least in Europe. But we would go further still, and argue that utopia is the first formalised medium of what contemporary theorists refer to as *imaginaries*.

The concept of the imaginary has been used to study the formation of identities and/or collectivities since the publication of *Imagined Communities* (Anderson, [1984] 2006). In this original conceptualisation, imaginaries are embedded in practices, providing the means by which individuals understand their collective social lives. The notion of sharedness is crucial: imaginaries are always a collective phenomenon. The concept was built on by Jasanoff and Kim (2009) through their defining of the *sociotechnical imaginary*, which sustained the emphasis on sharedness by connecting national identity construction with technoscientific activities. Subsequent formulations (Jasanoff, 2015) went on to downplay the role of national identity, embracing a more bottom-up origin story wherein a new imaginary might emerge in a small community, perhaps even from the work of a single individual, and accrue power and influence by diverse means.

Thus, sociotechnical imaginaries are defined as being 'collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology' (Jasanoff, 2015: 4) – but there is an explicitly moral dimension to this conceptualisation, too. Sociotechnical imaginaries are not only representations of the ways in which particular technologies and practices might be integrated into a reconfigured future society; they also inform us as to how lives which incorporate those technologies and systems 'ought, or ought not, to be lived' (Jasanoff, 2015). Other scholars have argued that imaginaries support a collective meaning-making process by 'structuring a field around a set of understandings that provide a sense of coherence and link actors into a network around the issue' (Levy and Spicer, 2013: 660); in this conceptualisation, imaginaries are a semiotic glue that bonds technical networks with social practices, a bonding agent integral to the assemblages in question rather than external to or separate from them.

With climate change commonly perceived as abstract and distant, overwhelming and difficult to grasp, imaginative engagements may serve to render it tangible. While the imaginaries concept has been central for the social sciences for decades, it is only recently that the notion of imaginaries has become adapted across disciplines dealing with climate change (for example, Strauss, 2015; Whiteley et al, 2016; Milkoreit, 2017). Yusoff and Gabrys (2011: 516) provided a point of departure, claiming climate imaginaries are 'a way of seeing, sensing, thinking, and dreaming the formation of knowledge, which creates the conditions for material interventions in and political sensibilities of the world'. Later, Levy and Spicer (2013) developed a definition of climate imaginaries that draws on Jessop's economic imaginary and extends it into the realm of climate change: for them, a climate imaginary is 'a shared socio-semiotic system of cultural values and meanings associated with climate change and appropriate economic responses' (Levy and Spicer, 2013: 662). Others focus less on the concept as such, and more on the techniques through which imaginaries 'act' (Hajer and Pelzer, 2018), as well as how new imaginaries can be conceived (Hajer and Versteeg, 2019) and be made governable (Kuchler, 2017).

Looking at the characteristics of sociotechnical and climate imaginaries, it seems uncontroversial to observe that they are a type of *narrative of futurity* (see Raven and Elahi, 2015), manifest in collectivity and particularised by the following characteristics:

- they are explicitly political, in that they are concerned with the (re)configuration of a future society, and also in that they are collectively held and developed;
- they are aspirational, in that they represent a yearning for what their adherents consider to be a *better* societal configuration; and
- they recognise not only the inevitability of a change in the environmental context, but the possibility – if not the necessity – of a change in the sociotechnical regime(s) that is in some way correlated with the desired societal betterment.

These characteristics illustrate just how closely these imaginaries lie to the utopian generic form, to the point that they might well be considered a variant or descendent thereof. This case can be made more fully by taking a more detailed look at the development of the utopian genre, from the perspective of its dominant contemporary equivalent, namely science fiction.

Utopia and science fiction

The relationship between utopia and science fiction[2] (SF hereafter) as literary genres remains in dispute, though the dispute is largely good-natured, with one side (comprising mostly SF scholars) holding that utopia should be seen as a subcategory of SF, while the other (predominantly utopian scholars) holds that SF is clearly a subcategory of utopia. Resolving this neighbourly territorial dispute is beyond the scope of this paper, and furthermore beside the point: the dispute illustrates the extent to which the two genres are entangled through their shared orientation toward futurity and/or social reconfiguration. Our work here relies on what we hope to be a productive blurring of the distinction, by way of the aforementioned concept of narratives of futurity (Raven and Elahi, 2015): this metacategory is defined as a set which contains all narratives which are distinguished by a timeline (explicit or otherwise) which extrapolates into the time ahead of the time of their creation; it thus includes many (and perhaps most) SF and utopian texts of any medium, as well as advertisements, political manifestos, economic forecasts, and a variety of other media not commonly recognised as being 'speculative' – though Vint (2019) makes the connection between the imaginative and financial-commercial forms of speculation admirably clear, by observing that they are both to some extent *promissory* (and thus political). This strategy also draws on a scholarship in which genre is increasingly understood less as being a category to which a given text does or does not belong, and more as a collection of qualities in which a given text may or may not partake to a greater or lesser extent.[3] Here we make a similar claim about the utopian generic form: while it is certainly the case that not all SF is utopian SF, the utopian impulse – the portrayal of a reconfigured society – is implicit in all narratives of futurity to a lesser or greater extent. The consequence of this observation is that we may treat the theoretical and critical apparatus of SF and utopia as being effectively contiguous at a certain level of ontological abstraction. Combined with the earlier observation that sociotechnical and climate imaginaries (in being political narratives of futurity) are also in effect partaking of utopian tropes, we thus conclude that we might productively

apply the theoretical and critical apparatus of SF and utopian literature to the analysis of imaginaries. Or, more succinctly: what better tools for building, disassembling and understanding narratives of futurity than those tools developed by those who study and create narratives of futurity?

As such, we will rehearse and extend a tripartite typology of utopian narrative modes as set out by James (2003), building on the work of Moylan (1980). This typology is analogous to a dialectical development of the utopian form, with the understanding that the modes can and do coexist in a given cultural moment. Seen in this light, the first mode (the thesis) is the 'classic' (or constitutional) utopia, the second mode (antithesis) is the technological utopia, and the third mode (synthesis) is the critical utopia.

The first mode is the canonical utopian form, whose template was established by More's book of that name. According to James (2003: 219–20), its dominant thematic feature is the presentation of an ideal society, whose perfection has been achieved through legislative and constitutional changes, and/or what we would now think of as 'policy interventions'. James labels this mode the 'classic' utopia, but we propose to call it instead the *constitutional utopia*, as this label speaks more clearly to its distinguishing feature, namely the explicitly (if not exclusively) *political* reconfiguration of society. More's *Utopia*, for instance, features a democratic system of local and civic governance, something resembling a welfare state, and property held in common – constitutional elements which all stand in stark contrast to that of the Tudor England in which More developed his ideas.

The second mode is the *technological utopia*, which James associates most closely with the late 'Golden Age' of the science fiction pulp magazines, and in particular the tenure of Joseph Campbell as editor of *Astounding* magazine, from 1937 through to the late 1960s; however, precursor components of the technological utopian mode were manifest prior to Campbell, for example in the novels of Jules Verne, and some (but by no means all) of H.G. Wells. James (2003: 222) argues that the technological mode is distinguished firstly by its suspicion of the very notion of a perfect(ed) society. But while the technological utopia may reject perfectibility, its second distinguishing characteristic is its insistence on the possibility, if not the inevitability, of *betterment* – the creation of a better society – through exclusively technological means. The antithetical nature of the technological utopia thus lies not just in its rejection of the possibility of perfectibility for a more nebulous notion of 'better', but in its assumption (sometimes quite explicit) that *political* means of societal betterment are not just ineffective, but actively obstructive to that end. An example would be Robert Heinlein's 1940 short story 'The Roads Must Roll', a particularly USian technological utopia which depicts not only the literal hyper-mobilisation of production and consumption by means of high-speed travelators within and between cities, but also the hazards of permitting the presumed *ressentiments* of unionism to disturb a militaristic and hierarchical social cohesion.

The third mode is the *critical utopia*, a category established by Moylan (1980), who identified the critical mode as it emerged in the so-called 'New Wave' of science fiction writers, and in particular the late 1970s novels of Ursula Le Guin and Samuel Delany. As Moylan saw it, these works were a response to the failed utopian experiments of the 1960s and 1970s, but also to the constrictive turn to capitalist conformity and consumption that followed those failures, arguing that the critical utopia suggested 'a possible shift in the imaginative direction of United States culture: a shift from simple

negation [of the status quo] to *a negation with alternatives*' (Moylan, 1980: 236–7, emphasis added). While they clearly inherit the utopian tradition, these works 'do not imitate that form; rather, [they] have transformed (*aufgehoben*) the traditional utopia in the triple sense of that term: that is they have negated, preserved and transformed it.' (Moylan, 1980: 237). The critical utopian narrative was thus a response to '[the] contradictions in postwar capitalist existence as well as the many forms of resistance and alternatives to it have stimulated moves beyond the cynicism and fear – not to mention anti-communism – that inhibited the artistic and social imagination after World War II'; in other words, 'the critical utopia is both an artifact of contemporary capitalism and an artistic action against it' (Moylan, 1980: 238). Le Guin's justly famed *The Dispossessed* achieves this juxtapositional critique through the parallel portrayal of both the doctrinaire and scarcity-riven anarcho-syndicalist moon of Annares *and* the oppositional hegemon from which it broke away, the capitalist hierarchy of the planet Urras, through the point-of-view of a disaffected Annaresti scientist.

Returning Moylan's reading of the critical utopia to its position in James's typology, we can situate it as a synthesis of the preceding constitutional and technological modes by noting that such narratives are 'critical of the supposedly apolitical solutionism of the technological utopias which preceded them', while 'inheriting from the same source a suspicion of the very possibility of the ideal or perfected society as an achievable goal'. Hence, the critical utopia concerns the '*depiction of a utopian project in the process of undergoing its inevitable failure, even as it sustains the critique of the status quo implied by all utopian modes*' (Raven, in press, n.p.; emphasis in original).

The critical utopian surge in science fiction was short-lived, though its most notable progenitors (particularly Le Guin) continued to produce work with similar concerns, and younger writers (such as Kim Stanley Robinson) carried the torch through the techno-utopian decades on either side of the millennium. It is beyond the scope of this paper to explore the resurgence of critical utopian science fiction in the 2010s, but it is worth noting nonetheless, as it is taking place alongside a (sometimes painful) rehabilitation of utopian theory (see for example Wark, 2015) after its banishment to the furthest margins of neoliberal discourse.

Speculative revivals

While there has been a significant surge in debate about utopia in recent years, the term remains largely pejorative, with utopianism 'commonly dismissed as an irrelevant fantasy or traduced as a malevolent nightmare leading to totalitarianism' (Levitas, 2013: xii). The late John Urry argued persuasively that this has a lot to do with the supposed failure of Marxist programmes to successfully predict or produce 'the future', a critique which arguably reached its peak during the Cold War (Urry, 2016: 5). This widespread monstering of utopianism led to a retreat by the social sciences from anything that smacked even slightly of a programmatic or normative approach to the question of futurity.

While dreams of an improved society were sidelined, dreams of deterministically predicting the future accelerated after the Second World War. Work on simulating nuclear warhead yields using early computers gave rise to the assumption that the future was calculable, given sufficient data and processing power. With the war over, the US Office of Scientific Research and Development formed Project RAND, which was eventually spun off into the still-ubiquitous RAND Corporation. RAND

influenced Cold War strategic thinking, such as the principle of Mutually Assured Destruction, and became a blueprint for the modern foresight consultancy. One of its alumni, Herman Kahn, went on to shape the quantitative and trends-based foresight processes that he later dubbed 'scenarios'. Due to Royal Dutch Shell's adoption and expansion of the methodology, scenarios became the canonical form of strategic planning for states and global corporations. Curry (in press, n.p.) argues that a short-termist taste for justifying self-serving decisions already made was baked into the epistemological underpinnings of these supposedly future-oriented decision-making tools. And as we now know, even when those tools gave a fairly accurate picture of how the trends might work themselves out, they could easily be ignored, their predictions hidden from view or suppressed (Franta, 2018).

It bears noting that strategic foresight emerged from exactly the same paradigm of complex systems simulation as did the pioneering climate models; as such, they share an assumption that 'any given problem can be solved by the application of computation' which effectively 'internalises solutionism to the degree that it is impossible to think or articulate the world in terms that are not computable' (Bridle, 2018: 4). While climate modelling has emerged as the dominant form of knowledge about climate futures (Edwards, 2010), Urry reminds us that identifying the causes and consequences of climate change 'necessarily entails multi-disciplinary research and theory' (2016: 156), and 'concerns social and not just physical or technological futures' (p 157): we need not only to engage the direct physical-environmental effects of CO_2 emissions, but also the consequences of those effects as experienced by human beings. This is a mandate for speculative efforts that draw on quantitative modelling and the extrapolation of historical sociotechnical trends, but which combine them with (the often undervalued) imaginative and qualitative tools of the social sciences and humanities to perform the work of exploring climate-changed futures from a bottom-up, demand-side perspective. Urry's choice of words is telling when he argues that 'thinking futures' – note the plural – is a way of rehabilitating 'planning, but under a new name' (Urry, 2016: 12): in neoliberal Britain, at least, *planning* has long been framed as a synonym for (implicitly socialist) utopianism.

The speculative futures Urry was advocating – with a clear nod to the speculative literatures in which he saw such futures as having been sustained during the period of utopia's banishment – have in fact been emerging for some time. The convergence of design thinking with established traditions of scenario practice is resulting in the development of methodologies that are explicitly speculative rather than normative – less interested in making predictive claims, in other words, than in the exploration of possibilities (Hodgkinson and Healey, 2008). A variant closer to the core paradigm of scenario foresight is known as 'science fiction prototyping' (SFP), which involves the semi-unbounded creation of SF stories in order to extrapolate or develop a technical or scientific discovery into something approaching a use-case (Johnson, 2011). Due to its lack of theoretical grounding and its origins in commercial product development, it has been argued that SFP is less a methodology than a corporate visioning practice being promoted far above its abilities (Raven, 2018: 37–8); nonetheless, attempts have been made to extend this thinking-with-fiction technique so as to accommodate issues at the infrastructural scale (see for example Raven, 2014; Merrie et al, 2017) and demonstrate the utility of speculations as a space in which complex systems and their complex problems might be explored from a human perspective.

A more radical form of speculation informs the field of *design fiction*.[4] This practice, a branch or spur of the broader discipline of speculative design established by Dunne and Raby (see, for example, 2013) during their tenure at the RCA in London, draws on design thinking, critical theory and creative practice in order to develop prototypes for future products or services (Auger, 2013). These prototypes are not intended to ever be produced; the prototype performs instead as an imaginative prop (or a diegetic object, in cinematic terms – see for example Kirby, 2010) that draws the observer into an engagement with the implied future world in which such a product might exist. Or, more simply, design fictions critique future contexts in order to open up a discourse rather than close it down:

> Suspending disbelief about change is in line with speculative design – an approach on which design fiction draws – and relates to a primary focus on generating understanding and insights rather than finished products … So a design fiction is (1) something that creates a story world, (2) has something being prototyped within that story world, (3) does so in order to create a discursive space. (Lindley and Coulton, 2015: 210)

Design fiction and critical design has in turn informed the still–newer discipline of Transition Design, which seeks to bring the best out of transitions theory, Social Practice Theory and design thinking by combining them in a speculative-critical modality aimed at thinking about future infrastructures:

> Transition design could be used to mediate between socio-technical transition theories with their top-down hierarchical approaches, and social practice theories with their bottom–up focus on everyday life and flat ontology … what is specific in transition design is the connection to more macro-scaled societal structures and processes. (Hesselgren et al, 2018: 14)

For Levitas (2013), utopian speculations should not be seen as a marginal endeavour, but be sociology's central approach to the question of futurity. While outlining a deployment of utopia as method under the explicit and confrontational banner of 'the Imaginary Reconstruction of Society' (IROS), Levitas argues that:

> The encounter between sociology and utopia implies reconfiguring sociology itself. Sociology must affirm holism and must extend this to include 'the environment', locating our human and social existence within the 'natural' or material world. It must embrace the normativity that it has systematically sought to exclude, address the future which it has systematically sought to evade and engage with what it means and might mean to be human … This encounter also implies thinking differently about what constitutes knowledge. It challenges the assumption that sociology constitutes a form of knowledge while utopianism is simply a form of speculation, and seeks to legitimise utopian thought not as a new, but as a repressed, already existing, form of knowledge about possible futures. (Levitas, 2013: xv)

To reiterate a point made previously, then: on the basis of the productive conflation of imaginaries (whether sociotechnical or climatic) and utopian forms under the

metacategory of narratives of futurity, the tripartite modal model of utopian forms may serve as a lens through which imaginaries might be analysed and critiqued, and thus also as a set of templates or rubrics for the development of new imaginaries. In such a framework, the critical utopian mode may be seen as a synthesis form that represents a path between the Scylla of the 'purely' political constitutional utopia on the one hand, and the Charybdis of the solutionist and reactionary technological utopia on the other, and offering a compass for the methodological journey proposed by Levitas above. Indeed, in our view, Levitas's call is partly answered by the speculative revivals of recent years that are forcing their way through the asphalt of quantitative trends-based futuring. While 'the future' – understood as a one-size-fits-all singular somewhen at which we will eventually arrive – is perhaps the greatest fiction of them all, the undeniable uncertainty of the present necessitates a plurality of narratives, not to predict futures, but rather to probe them. The MCR, the initiative that features as a case study in the following section, is one such story.

Case study: The Museum of Carbon Ruins

On 9 April 2019, around 100 people attended the opening of the MCR exhibition in Lund, Sweden. A museum employee identifying themselves as chief curator took the microphone and addressed the crowd, reminding them that the date was now 2053.

> 'We're happy to welcome you to Sweden's newest museum, *FOSSIL*. It is a celebration of the fact that we reached global net-zero emissions of carbon dioxide in 2050. In Sweden, as you all know, we reached net-zero emissions five years earlier than that, in 2045! We were the first country in the world to step out of the Fossil Age …'

Applause and smiles rippled through the audience, before attention returned to the curator, pointing to a large vertical canvas hanging from the roof, on which a timeline is painted: ***The Fossil Age, 1849–1949***. "We have a long and messy history with fossil fuels," he said.

> 'From 1849 to 1972, during the Great Expansion, we dug up more and more. They made steel production cheap, fuelled local and international travel and freight. The world became smaller, and the opportunities seemed endless.'

The curator quickly passed milestones such as the first coal-fired power plant, the release of the Ford Model-T and the introduction of plastics. The second era, the Fossil Fears, was defined by the oil crises of the 1970s. The curator reminded the audience of how it became increasingly clear that burning those fuels was causing climate change – but even as international treaties were ratified at Kyoto and Paris, debate persisted as to whether climate change was a substantive issue. They then pointed to the last few decades of the timeline.

> 'Around 30 years ago, we started to see an acceleration of change: we entered the Transition Years. Massive mobilisations of social movements – strikes, sit ins, demonstrations. The carbon bubble burst. Companies that made their revenue from fossil fuels were deemed high-risk; their stock plummeted,

outcompeted by renewable energy sources. A coal power-plant turned from being an asset to a liability.'

They identified key moments where regulators finally caught up, the crucial struggles and victories through the 2030s, the eventual triumph of 2045. But the transition was not pain-free: some species were lost forever, and controversial decisions led to conflicts around Europe.

For the next twenty minutes, the audience toured the exhibition, guided by the curator, encountering objects such as a frequent-flyer card (donated by a climate change researcher who stopped flying in 2017), vintage fossil-plastic Lego and a steel bottle stored away during the steel shortages of the 2030s. A piece of concrete prompts a longer discussion about how skyscrapers became too expensive to build once carbon taxes were imposed. One of the last fast-food hamburgers ever served gets a lot of attention, with questions from the audience about the transition to lab-grown meats. In total, around 60 objects were on display, each illustrating a moment in the Transition Years, with explainer texts and curatorial staff on hand to unpack their stories and relevance.

About the exhibition

The MCR is a product of several initiatives at Lund University. (Please see the end of this paper for full details of funding.) The intention for MCR was to generate new kinds of stories about a climate-changed future, and new ways of telling those stories. Visitors are transported in space and time to a future where the transition to a post-fossil sociotechnical regime *has already happened*: future low-carbon lifestyles are normalised, while contemporary practices of consumption are framed as strange and unfamiliar. The exhibition focuses on the last few decades of the 'Fossil Era', highlighting what had to be given up and what came to replace it, and depicting some of the conflicts along the way.

MCR is a space for reflection, within which visitors may start to imagine themselves living in a reconfigured future. Visiting MCR is an immersive experience, with the objects and the images brought to life through the stories told about them. The exhibition guide's performance has a key role, but often the audience starts to join in, describing their personal 'memories' from the Transition Years. The dialogue that results is thus unique every time, shaped by the composition of each batch of visitors. This meeting and engagement with an audience is very much by design: the key feature of MCR is not the 'exhibits', but the discussions that the exhibits provoke. As such, it can be seen as a method, as well as an end in itself.

Form and influences

Seen from the perspective of futures studies, MCR bears some similarities to a scenarios methodology known as backcasting (see Bishop et al, 2007), whereby a certain configuration of the future is assumed in order that pathways to realising said future might be traced back to the present – but MCR resists the implicit normalising urge of backcasting (Wangel, 2011) in favour of a more exploratory mode of speculation. This is achieved in part through the use of an imagined institution (the museum) as a framing device: aesthetic and pedagogical strategies from the world of

museums, wherein objects carry personal stories, particular contexts and life histories, provide a framework within which suspension of disbelief is easily produced. Since the exhibition is set in the future, MCR also makes use of science fictional strategies of speculation to imagine and explore this 'other world', as well as techniques and tropes from speculative design (see above), wherein the designed object is not meant for production, but for reflection; there is also significant influence from concepts of familiarity and estrangement as deployed in anthropology. The interlocution and narration of the 'exhibition guides' draws on techniques established within the fields of immersive theatre and performative communications. But beyond the mash-up of methods, MCR is built on deliberation, engagement and the collective construction of speculative futures.

Objects, stories and publics

By focusing on recognisable and culturally resonant physical objects, MCR aims to bridge the cognitive gap between the concrete everyday lives of humans and the abstract impacts of climate change. The choice of the objects and the associated stories are based on an aggregate of climate models and expertise from the Climaginaries network. The characters and events which populate the stories which surround the exhibits have been generated through participatory workshops involving researchers and practitioners from sectors including food, transport, steel, energy, plastic and climate futures more broadly.

The MCR exhibition was staged at a number of different municipal and civic locations in Lund. This local 'tour' with four stops is a significant feature: since the public at each site is differently constituted, MCR becomes in each case whatever each audience cohort *collectively* makes of it. This means that different questions come to the fore in discussion, but that the exhibition itself is also changing, as new stories are crafted in collaboration with each audience. For instance, in advance of the move to the Cathedral, the MCR team were engaging Svenska Kyrkan representatives to craft new stories addressing the role of the church during the transitions years; as Svenska Kyrkan starts to formulate its own climate strategy, MCR thus provides a reflective space within which ideas might be experimented with.

Discussion: toward an ethics of speculation

There are endless possibilities for posing ethical questions in relation to speculative projects like MCR, and to speculative futuring more generally. Rather than provide a supposedly definitive 'answer' – an aspiration which would itself be ethically absurd – our aim here is to initiate a conversation around these issues which has not been much foregrounded in the speculative turn so far. In our view, one could usefully think about the ethical issues in MCR, and other projects like it, from three perspectives: the *fact of the work*, the *ends of the work*, and *the means of the work*.

The fact of the work

By the fact of the work, we mean that the work is being done at all: is the project of speculating on sociotechnically reconfigured futures an ethical undertaking? There is of course a question of virtue ethics embedded in the implicit assumption

that decarbonising society is itself a worthwhile project. In the case of MCR, that evaluation of virtue has been made by the Swedish government, and is expressed through their adopting a policy of net-zero carbon emissions by 2045. The virtue of those policies can be debated, as is appropriate in a democratic society, but the ethics of these policies *in and of themselves* are effectively beyond our remit.

While it would be possible to imagine deontological arguments against the speculative work represented by MCR and similar projects, we will assume that it is implicit that we see no conflict between such work and our 'duty' as academics and public servants, and further that our own epistemological positionalities put us very much on the consequentialist side of the fence. And there is indeed a consequentialist case for speculative decarbonisations: they may be seen as ethical evaluations, intended to ensure that the policies are enacted in a fair and viable way, flagging up potential problems in implementation before they arrive, and thus allowing them to be tweaked and adjusted accordingly. In effect, projects like MCR aim to fill in the deliberative gaps in the process of policy production, allowing citizens to be part of a process from which they are normally very distant.

In focusing on qualitative social dimensions of socio-material transitions, these projects might be said to fill in the details of a speculative future which has heretofore been sketched mostly in technical and quantitative terms. From this position, to ask whether it is ethical to speculate about the social dimensions seems almost fallacious – indeed, it would seem more unethical to *not* provide a space where such concerns can be articulated, if given the choice. But this brings us to the teleological dimension: are the goals of the work as ethical as they claim to be?

The ends of the work

The teleological question brings us into slightly murkier waters, because in projects like MCR there is an explicit aim to persuade a variety of imagined audiences that the decarbonisation reconfigurations depicted are not only *technologically* achievable within the timelines defined in the policies, but also *politically* achievable.

That the transition to a post-fossil society is *technologically* feasible has been a given for some time. The *political* feasibility of decarbonisation is rather more vexed, however, both at the levels of national and international institutions, and at the more intimate level of individual lives. Regarding the former, it is simple enough to design policies that constrain carbon emissions; however, passing those regulations and incentives through the legislative process (and the associated systems of corporate lobbying) is quite another matter, as is the challenge of actually enforcing any legislation so enacted (Newell and Paterson, 1998). But again, this issue is beyond the scope of MCR and other such speculative projects, which start from the assumption that the policies will be created and implemented: it is the *consequences* of those policies, and in particular the ways in which they might affect the lives of ordinary citizens, that are foregrounded.

With regard to the political possibility of decarbonised lifestyles as seen from the demand-side (or 'social') perspective, the challenge of implementation is perhaps less rooted in obstruction than in inertia. Put very simply, the issue is the obduracy of practices (see Shove, 2004; Shove et al, 2007; Shove, 2010), particularly those underpinned by long-established infrastructures which have effectively superseded (and, in some cases, eradicated the possibility of) earlier, lower-impact alternatives.

While changes in the technological and infrastructural underpinnings of these practices may well be necessary, such changes can only be accommodated by a concomitant shift in the values and meanings associated with the practices in question. In other words, people must desire to do things differently, and recognise that doing so either maintains the social meaning of the practice as they already perform it, or changes that meaning in a way that is agreeable to them.

It follows that to realise a post-fossil society, even if it is not sufficient to merely imagine life in such a state, then it is surely necessary, or at least helpful. This brings us to the question of persuasion – for what is MCR about, if not persuading audiences that a zero-carbon future is not only possible but plausibly desirable? But there is a subtle distinction here which is worth teasing out further: while there is a persuasive dimension to MCR, it is less about trying to 'sell' the policies like a marketing campaign, and more about trying to portray the policies as politically and pragmatically valid, while providing the space for those who will do the living to figure out what they might mean.

Our rejection of the role of salespersons is, we hope, supported by the evidence of the criticality implicit in the work. Far from presenting the future implied by decarbonisation policies as a frictionless utopia, MCR is at pains to emphasise the struggles, conflicts and losses that the transition will entail, while at the same time trying to depict a successful transition in a light as plausible and hopeful (as opposed to optimistic) as possible. Or, in the vernacular: MCR isn't saying 'the future will be great!', but rather saying 'the future will be difficult, but change is possible, and if we stay the course there will be a variety of upsides and improvements to balance out the downsides and losses'. This is the sense in which MCR is working in the critical utopian modality: it presents and fosters narratives which embrace the possibility and necessity of societal transformation, while refusing both the constitutional utopia's totalitarian political perfection and the anti-political solutionism of the capitalist-realist technological utopia. In more practical terms, the purpose of the work is to render the policies (and the contextual factors which necessitate them) more legible to non-expert audiences: to make it easier for citizens to grasp implications (both positive and negative), and to evaluate and critique the futures that the policy is promising them.

The eurocentricity of MCR could be considered ethically problematic, given it is a project that limits its narrative frame to Sweden and other nearby nations, all of which are relatively privileged by comparison to the global norm. Or, to put it another way: is MCR just a comforting utopian SF story for residents of Northern Europe? It is a hard accusation to dodge in many respects, but we would counter that its local and regional focus would only become problematic were it being presented as a blueprint for other states to follow exactly. Indeed, a local focus is unavoidable if speculative work is to be done effectively: any attempt to realise and portray the combined effects of climate change and sociotechnical reconfigurations must take into account a variety of geographical variations, such as in environmental conditions, projected climate change impacts, demography, and the sociotechnical, political and economic status quo, to name just a few. As discussed above, this is one reason why speculative decarbonisation is valuable: it forces the research community to translate abstract climate science and policy into the everyday course of life. Localised speculations offer the chance to expose and explore the tensions between the inevitably generalised policy targets and the equally inevitable specificity of their everyday consequences. (A local focus is also a corrective to the placeless solutionism

of vapourware mitigation proposals such as Carbon Capture & Storage or Solar Radiation Management techniques.)

As a methodological template, MCR offers other states/sites a format for developing their own critical utopias of decarbonisation, and to give voice to perspectives that inevitably tend to get drowned out in more globally focussed explorations of policy. We are minded of Haraway's observation that so-called objectivity is the white man's 'god trick', and that *situated* research – which does not merely assume subjectivity, but embraces it – is a route that has much to offer. And it is a mistake to assume that the truths so surfaced will necessarily not be of more general relevance: as she put it herself, '[t]he only way to find a larger vision is to be somewhere in particular' (Haraway, 1988: 590). With that in mind, speculations of this sort should take care to avoid treating non-local spaces as externalised sources or sinks: simply relocating the carbon emissions and waste disposal required to support a northern-European lifestyle to states in the far east or global south is an ethically unacceptable fudge. MCR largely ignores the global context in which the Swedish emissions target has been achieved – whether similar goals have been reached elsewhere in the future world it depicts is a question that goes unasked – but care has been taken to ensure that the reconfigurations portrayed are not simply outsourcings of emissions.

In a similar vein, there are intersectional issues with MCR, which, through its attempts to address a notional future audience, necessarily makes reductive assumptions about the composition of that audience, and about the characters and events in the narratives contained within it. The researchers and practitioners involved have made sincere efforts to make the exhibition itself and the future it portrays as inclusive as possible in terms of different ethnicities, genders and abilities, but it would be a fair criticism to note that this is largely through a paucity of specific characterisation. By leaving the narrative space open for the audience to populate, MCR is in theory as diverse as the group viewing it – but given the venues where it has featured thus far, we can assume that this diversity is largely limited to the variance to be found within groups of affluent middle-class Scandinavians.

The same issue attends to the diversity of MCR's creators. While the core group is of equal gender balance, academia is still not a diverse space in terms of ethnicity and economic circumstance. However, we maintain that the ethical thing is to do the best we can, in the understanding and expectation that we can and will be criticised for overlooking or marginalising certain perspectives, and that such criticism should be welcomed as an opportunity to improve the work. There are risks attendant on our efforts, of course, but they seem to be outweighed by the risks and hazards of *not* speculating about decarbonisation.

The means of the work

Finally, we turn to the means of the work: the manner and methods of the speculative process. Here we find a range of challenges and risks for practitioners and researchers engaged in such work.

A genuine concern with speculative futures regards their potential to become unintentional hoaxes, deceiving their viewers into believing that what they are seeing is actuality. This is of particular concern in the design fiction field, which explicitly leverages the seeming plausibility of its 'products' in order to enact the estrangement that builds the 'cognitive bridge' (Auger, 2013) to critique: for a design fiction to

be effective, it has to skate as close to the edge of hoaxing as possible. This concern has exercised practitioners and theorists in the field for some time, particularly the science fiction author turned design critic Bruce Sterling, who summed up the issue neatly when he observed that 'design fiction has an audience, not victims': as design fiction relies on the suspension of disbelief, then 'design fiction has an ethics' (Sterling, 2013). He notes also that corporations routinely promise products which they have no intention of actually building as a promotional gambit, a way to intervene in the melee of sociotechnical imaginaries. Design fiction exploits similarly the expectations created by such efforts, and can thus be seen – at its most idealistic – as a counterintervention against the capitalist intentions of 'vapourware' designs.

But therein lies the ethical issue: seen in this way, design fiction and similar speculative strategies appropriate the deceptive and persuasive tools of marketing and public relations in an attempt to undo, or at least counter, the solutionist sociotechnical imaginaries that they usually generate. A similar issue can be seen as attending any speculative imaginings or narratives of futurity: the science fiction author Charlie Stross is fond of saying to audiences 'I tell lies for a living', and there is a significant tradition of SF authors turning their imaginations to the purposes of the military-industrial complex, as well as to less obviously destructive or deceitful industries (Merchant, 2018).

Intentionality obviously makes a big difference – and as noted above, as the creators of MCR, we explicitly abjure the role of salespersons. But the tools of depiction and estrangement being used in MCR to explore the possibilities of a speculative future are exactly the same as those used to sell political programmes and technological 'solutions'. Keep in mind, however, that design fiction traditionally skates far closer to the line of hoaxiness than does MCR. While design fictions frequently produce speculative artefacts within a deceptive and fabricated institution that acts as a framing narrative, MCR is actually using real artefacts; it is only the frame narrative of the museum that is a fabrication, the effect of which is to perform an estrangement on objects whose 'realness' and familiarity is the key to their power.

It also bears noting that MCR is a fairly obviously fictional frame: by tying itself to a very specific date in the relatively distant future, the 'bargain' of suspension of disbelief is struck in an open and non-exploitative manner. The realness of the artefacts also ensures that there is little likelihood of an image or artefact being excised from the carefully-constructed framing narrative and being republished elsewhere in a different, more exploitative or hoaxy context – though there is a real and unavoidable risk that the project as a whole is reframed by certain media outlets with a climate-denial or climate-sceptic agenda in order to position it as a wasteful indulgence of liberal academia.

Conclusion

In late November 1895, Alfred Nobel signed the testament that gave his fortune to prizes in physics, chemistry, medicine, peace and literature for 'the greatest benefit to humankind'. In Nobel's words, the prize in literature shall be awarded to the one who has produced the most outstanding work in an ideal direction. Nobel clearly thought that both the factual worlds of the natural sciences and the fictional worlds of literature were important in our efforts to make the world a better place. While the microscope, the telescope and the computer have been key devices for the natural

sciences, fiction is the strongest device of literature – and all of these devices are important for climate imaginaries, as they allow ways of 'seeing, sensing, thinking, and dreaming' (Yusoff and Gabrys, 2011: 516) and thereby intervening and acting in the world.

What is life like in a post-fossil society? What are the key decisions and events that could take us there? How will the decarbonisation transitions shape the ways in which we live, eat, travel, warm our houses, or drink our morning coffee? Yes, these are speculative questions – but not idle ones. As we insist in this paper, we need to invent and foreground methods and practices that provide speculative spaces where such questions can be articulated. While speculation has spent many years at the margins of the social sciences, key figures such as Levitas and Urry make the case for its reintegration. We agree that we need to 'think futures' to rehabilitate planning (Urry, 2016), and to use critical utopias to address the futures that sociology has tried to evade (Levitas, 2013). While we are happy to see a 'speculative turn' sweeping through contemporary academia, we think the time is ripe to initiate a reflection about what an ethics of such speculative endeavours might entail.

We used our own speculative initiative – the MCR – as a foil for questions about why we did it, how we did it, and the consequences of doing it. We situate MCR in a critical utopian modality, in which societal transformations are deemed necessary, but where the classical-utopian baggage of political perfection or technological-determinist betterment are banished. Hence, while MCR could stand accused of 'outsourcing' some ethical issues to the Swedish state – the premise of being post-fossil by 2045 – we find plenty of other ethical issues that are worth foregrounding. Speculative policy work of the sort that MCR represents actually adds an ethical dimension to the zero-carbon policy pathways which is often not articulated: rather than foreclosing on ethical possibilities, MCR allows citizens to grapple, evaluate, amend and critique the post-fossil futures that official policy is striving towards.

MCR and other design fictional forms may initially appear to be more directly deceitful than other forms of foresight. By portraying their speculative futures as if they had already arrived – presenting the future as the present, in other words – they work like science fiction, inviting an audience to willingly and knowingly enter the bargain of suspended disbelief. We think that is a fair bargain – far more fair than the proliferating political and/or technological utopian assertions of 'how the future will be' that currently manifest in breathless (and increasingly desperate) descriptions of national networks of driverless electric vehicles and the aseptic architectural renderings of the 'smart city'. That there are ethical issues attendant on speculative projects such as MCR is evident; that those ethical interrogations should be extended with equal or greater strength to speculative futures which masquerade as predictions seems undeniable.

While its collectivity is somewhat limited by the circumstances and means of its production, we nonetheless see MCR as a sociotechnical and/or climate imaginary, or at least as an attempt at an intervention in the wider field of such imaginaries; furthermore, in its refusal of utopian perfection and its (at times uneasy) balance between technological and political reconfigurations, we also see it as partaking of the critical utopian mode. On these points, however – as with the ethical particularities discussed above – we are of course putting ourselves in the position of 'marking our own homework', so to speak! But the goal of MCR was always to stimulate discussion and engagement rather than to dictate a particular promissory future, and we hope

that the same will be true of the autocritique of the project presented herein. As such we offer this work (and our reflections on it) not as some exemplary culmination of speculative methods, but rather as an experiment in speculative methodology, as well as an invitation to greater ethical reflexivity and critique in speculative practice, whether within the academy or beyond it.

Notes

[1] The other meaning of 'speculation', which is more closely tied to the world of finance, is far from fully distinct from this more imagination-oriented usage – a point admirably illustrated by Vint (2019).

[2] It bears noting that, over the years, numerous scholars and writers have argued in favour of the broader term 'speculative fiction' for a variety of reasons (ranging from the reasonable observation that there is very little 'science' in much of what is labelled 'science fiction', to a wish to not be pigeonholed under a potentially pejorative generic category). While in some respects the 'speculative fiction' option would seem better suited to the topic of this particular paper, we note that 1) 'speculative fiction' lacks the household-name familiarity of 'science fiction', meaning that the latter is likely more recognisable as a category to those unfamiliar with the internecine debates of paraliterary praxis and scholarship, and that 2) as well as 'science fiction' and utopian forms, the category of 'speculative fiction' tends to also subsume fantasy, horror and supernatural fiction, among other subgenres; for all its troubled history and semantic inaccuracy, the broad and generalised conception that 'science fiction' is for the most part oriented toward questions of futurity and/or societal reconfiguration (as, for example, fantasy is not) makes it the more accessible and less muddying label in the context of this discussion.

[3] This 'evaporation of genre' has been examined from a literary-critical perspective by Wolfe (2011) and others; a more materialist-historical rehearsal of the argument, tying it to means of production and distribution, may be found in Rieder (2017).

[4] The coining of the term 'design fiction' is frequently credited to SF author turned design critic Bruce Sterling, but Sterling has repeatedly disowned the coining, crediting it instead to practitioner and theorist Julian Bleecker (Sterling, 2013).

Funding

Acknowledgements

Lysko (ditto), Ludwig Bengtsson Sonesson (LU Sustainability Forum), Alexandra Nikoleris, (Environmental and Energy System Studies, LU), Caroline Mårtensson (independent artist), and Johannes Stripple (Department of Political Science, LU). Read more about Carbon Ruins here: climaginaries.org/carbon-ruins

Conflict of interest

The authors declare that there is no conflict of interest in this paper.

References

Anderson, B. ([1984] 2006) *Imagined Communities: Reflections On the Origin and Spread of Nationalism*, London: Verso.

Auger, J. (2013) Speculative design: crafting the speculation, *Digital Creativity*, 24(1): 11–35. doi: 10.1080/14626268.2013.767276

Bishop, P., Hines, A. and Collins, T. (2007) The current state of scenario development: an overview of techniques, *Foresight*, 9(1): 5–25. doi: 10.1108/14636680710727516

Bridle, J. (2018) *New Dark Age: Technology and the end of the Future*, London: Verso.

Curry, A. (in press) A critical history of scenario planning, in M Buscher, C Lopez Galviz, A Mordin and E Spiers (eds) *The Handbook of Social Futures*, Abingdon: Routledge.

Dictionary.cambridge.org (2019) Speculation, https://dictionary.cambridge.org/dictionary/english/speculation

Dunne, A. and Raby, F. (2013) *Speculative Everything: Design, Fiction, and Social Dreaming*, Cambridge, MA: MIT Press.

Edwards, P. (2010) *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming*, Cambridge, MA: MIT Press.

Franta, B. (2018) Shell and Exxon's secret 1980s climate change warnings, *The Guardian*, 19 September, www.theguardian.com/environment/climate-consensus-97-percent/2018/sep/19/shell-and-exxons-secret-1980s-climate-change-warnings

Hajer, M.A. and Pelzer, P. (2018) 2050 – an energetic odyssey: understanding 'Techniques of Futuring' in the transition towards renewable energy, *Energy Research & Social Science*, 44: 222–31.

Hajer, M. and Versteeg, W. (2019) Imagining the post-fossil city: why is it so difficult to think of new possible worlds?, *Territory, Politics, Governance*, 7(2): 122–34. doi: 10.1080/21622671.2018.1510339

Haraway, D. (1988) Situated knowledges: the science question in feminism and the privilege of partial perspective, *Feminist Studies*, 14(3): 575–599, doi: 10.2307/3178066

Hesselgren, M., Eriksson, E., Wangel, J. and Broms, L. (2018) Exploring lost and found in future images of energy transitions: towards a bridging practice of provoking and affirming design, *Proceedings of Design Research Society Catalyst 2018*.

Hodgkinson, G.P. and Healey, M.P. (2008) Toward a (pragmatic) science of strategic intervention: design propositions for scenario planning, *Organization Studies*, 29(3): 435–57. doi: 10.1177/0170840607088022

James, E. (2003) Utopias and Anti-utopias, in E. James and F. Mendlesohn (eds) *The Cambridge Companion to Science Fiction*, Cambridge: Cambridge University Press, pp 219–29.

Jasanoff, S. (2015) Future imperfect: science, technology, and the imaginations of modernity, in S. Jasanoff and S.H. Kim (eds) *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*, Chicago, IL: University of Chicago Press, pp 1–33.

Jasanoff, S. and Kim, S.H. (2009) Containing the atom: sociotechnical imaginaries and nuclear power in the United States and South Korea, *Minerva*, 47(2): 119. doi: 10.1007/s11024-009-9124-4

Johnson, B.D. (2011) *Science Fiction Prototyping: Designing the Future with Science Fiction*, Williston, VT: Morgan & Claypool.

Kirby, D. (2010) The future is now: diegetic prototypes and the role of popular films in generating real-world technological development, *Social Studies of Science*, 40(1): 41–70. doi: 10.1177/0306312709338325

Kuchler, M. (2017) Post-conventional energy futures: rendering Europe's shale gas resources governable, *Energy Research & Social Science*, 31: 32–40.

Levitas, R. (2013) *Utopia As Method: The Imaginary Reconstitution of Society*, London: Springer.

Levy, D.L. and Spicer, A. (2013) Contested imaginaries and the cultural political economy of climate change, *Organization*, 20(5): 659–78. doi: 10.1177/1350508413489816

Lindley, J. and Coulton, P. (2015) Back to the future: 10 years of design fiction, *Proceedings of the 2015 British HCI Conference*, New York, NY, USA: Association for Computing Machinery, pp 210–11. doi: 10.1145/2783446.2783592

Merchant, B. (2018) Nike and Boeing are paying Sci-fi writers to predict their futures, One Zero, Medium, 28 November, https://onezero.medium.com/nike-and-boeing-are-paying-sci-fi-writers-to-predict-their-futures-fdc4b6165fa4

Merrie, A., Keys, P., Metian, M. and Österblom, H. (2017) Radical ocean futures –scenario development using science fiction prototyping, *Futures*, 95: 22–32. doi: 10.1016/j.futures.2017.09.005

Milkoreit, M. (2017) Imaginary politics: climate change and making the future, *Elementa Science Anthology*, doi: doi: 10.1525/journal.elementa.254.

More, T., Miéville, C. and Le Guin, U.K. (2016) *Utopia*, London: Verso.

Moylan, T. (1980) Beyond negation: the critical Utopias of Ursula K. Le Guin and Samuel R. Delany, *Extrapolation*, 21(3): 236–53. doi: 10.3828/extr.1980.21.3.236

Newell, P. and Paterson, M. (1998) A climate for business: global warming, the state and capital, *Review of International Political Economy*, 5(4): 679–703. doi: 10.1080/096922998347426

Raven, P.G. (2014) The future's four quarters: proposing a quadrant methodology for strategic prototyping in infrastructural contexts, *Technological Forecasting and Social Change*, 84: 115–30, https://doi.org/10.1016/j.techfore.2013.10.012 doi: 10.1016/j.techfore.2013.10.012

Raven, P.G. (2018) Making infrastructure legible, *PhD Thesis*, University of Sheffield, http://etheses.whiterose.ac.uk/22772/

Raven, P.G. (in press) Policy without polity: wising up to the solutionist utopia of the 'smart city', in M. Buscher, C. Lopez Galviz, A. Mordin and E. Spiers (eds) *The Handbook of Social Futures*, Abingdon: Routledge.

Raven, P.G. and Elahi, S. (2015) The new narrative: applying narratology to the shaping of futures outputs, *Futures*, 74: 49–61. https://doi.org/10.1016/j.futures.2015.09.003 doi: 10.1016/j.futures.2015.09.003

Rieder, J. (2017) *Science Fiction and the Mass Cultural Genre System*, Middletown, CT: Wesleyan University Press.

Schmitt, J.C. (2000) Appropriating the future, in J.A. Burrow and I.P. Wei (eds) *Medieval Futures: Attitudes to the Future in the Middle Ages*, Woodbridge: Boydell & Brewer, pp 3–18.

Shove, E. (2004) *Comfort, Cleanliness and Convenience: the Social Organization of Normality*, London: Berg.

Shove, E. (2010) Beyond the ABC: climate change policy and theories of social change, *Environment and Planning A*, 42(6): 1273–85. doi: 10.1068/a42282

Shove, E., Watson, M., Hand, M. and Ingram, J. (2007) *The Design of Everyday Life*, London: Berg.

Sterling, B. (2013) Patently untrue: fleshy defibrillators and synchronised baseball are changing the future, *Wired*, 11 October, www.wired.co.uk/article/patently-untrue

Strauss, K. (2015) These overheating worlds, *Annals of the Association of American Geographers*, 105(2): 342–50. doi: 10.1080/00045608.2014.973805

Urry, J. (2016) *What is the Future?*, Cambridge: Polity Press.

Vint, S. (2019) Promissory futures: reality and imagination in finance and fiction, *CR: The New Centennial Review*, 19(1): 11–36. doi: 10.14321/crnewcentrevi.19.1.0011

Wangel, J. (2011) Exploring social structures and agency in backcasting studies for sustainable development, *Technological Forecasting and Social Change*, 78(5): 872–82. doi: 10.1016/j.techfore.2011.03.007

Wark, M. (2015) *Molecular Red: Theory for the Anthropocene*, London: Verso.

Whiteley, A., Chiang, A. and Einsiedel, E. (2016) Climate change imaginaries? examining expectation narratives in cli-fi novels, *Bulletin of Science, Technology & Society*, 36(1): 28–37. doi: 10.1177/0270467615622845

Wolfe, G.K. (2011) *Evaporating Genres: Essays on Fantastic Literature*, Middletown, CT: Wesleyan University Press.

Yusoff, K. and Gabrys, J. (2011) Climate change and the imagination, *WIREs Climate Change*, 2(4): 516–34, doi: 10.1002/wcc.117