



## Futures literacy and the diversity of the future

Astrid C. Mangnus<sup>a,b,1</sup>, Jeroen Oomen<sup>a,b,\*</sup>, Joost M. Vervoort<sup>a,b,c,2</sup>,  
Maarten A. Hajer<sup>a,b</sup>

<sup>a</sup> Copernicus Institute of Sustainable Development, Utrecht University, Princetonlaan 8a, 3584 CB Utrecht, the Netherlands

<sup>b</sup> Urban Futures Studio, Utrecht University, Heidelberglaan 8, 3584 CS Utrecht, the Netherlands

<sup>c</sup> Environmental Change Institute, University of Oxford, South Parks Road, Oxford OX1 3QY, United Kingdom

### ARTICLE INFO

#### Keywords:

Futures literacy  
Reflexivity  
Techniques of futuring  
Epistemology  
Engagement

### ABSTRACT

In this paper, we argue that a key component of futures literacy is reflexivity regarding different attitudes toward the future. Various intellectual traditions and futures practices make epistemologically distinct claims about the future and its manifestations in the present. Through their different outlooks on analyzing, understanding, and influencing the future, these diverse approaches represent fundamentally different attitudes to what it means to meaningfully engage with the future. Because of this diversity of attitudes toward the future, and the different possible modes of engagement with the future, futures literacy is more complex than it appears at first glance. Looking at recent developments in futures literature, we build on four epistemologically and ontologically distinct approaches to the problem of the future. We argue that being futures literate depends on reflexivity about these different engagements with the future, and what these different approaches can offer future-oriented action respectively. Such reflexivity entails being reflexive about how different approaches to the problem of the future arise, as well as about the underlying power structures. We also investigate possibilities to cultivate this futures reflexivity and conclude with a set of questions to guide future research in deepening reflexivity as a key element of futures literacy.

## 1. Introduction

The most lasting heirlooms of the past decades of studying the future are arguably the forward-looking practices that have created specific tools, methodologies, and artefacts with which to engage with the future, such as scenario development and simulation modelling (Andersson, 2018). These tools and practices have become “*staples of global governance*” (Andersson, 2018, p. 10). As such, they have come to inform and shape not only what it means to know the future, but also *how to* anticipate and interact with it. Importantly, these forms of future orientation rely on particular notions of projectivity, or the inherent future-oriented nature of agency and action, and of futures literacy, or the ability to use an appreciation of *projectivity* to act upon the future.

As Emirbayer and Mische (1998) recognized, all agency necessarily has to be future-oriented to some extent, because it is through projectivity that action attains its imagined value and meaning. Yet despite this, most people remain unaware of the projectivity of

\* Corresponding author.

E-mail addresses: [a.c.mangnus@uu.nl](mailto:a.c.mangnus@uu.nl) (A.C. Mangnus), [j.j.oomen@uu.nl](mailto:j.j.oomen@uu.nl) (J. Oomen), [j.m.vervoort@uu.nl](mailto:j.m.vervoort@uu.nl) (J.M. Vervoort), [m.a.hajer@uu.nl](mailto:m.a.hajer@uu.nl) (M.A. Hajer).

<sup>1</sup> Affiliation address: Room 7.42, Princetonlaan 8a, 3584 CB Utrecht, The Netherlands.

<sup>2</sup> Affiliation address: Room 7.40, Princetonlaan 8a, 3584 CB Utrecht, The Netherlands.

their own actions. To a significant extent, futures literacy as a field of research and intervention is predicated on the observation of people's inability to act on the future. For Riel Miller (2007; 2018), a pioneer in futures literacy, this inherent future-orientedness of behavior means it is important to educate people in futures literacy, enhancing their capacity to act on the future. At the same time, however, there exists a great variety in attitudes toward the future—as well as a variety of interpretations of what it might mean to be futures literate. Because of the diversity of attitudes toward the future, and the possibilities for modes of engagement with different futures, futures literacy is more complex than it first appears. As Lemke and Van Helden (2015) point out, literacy itself is a complex word. Originally denoting specific individual competencies, literacy has increasingly come to describe a process of collective meaning-making. This means that in a rapidly changing society facing uncertain futures, it is also uncertain which literacies are called for (Cope & Kalantzis, 2015; Lemke & Van Helden, 2015). In addition to more widely recognized literacies around knowledge, internalized design, and research, multiple ways of anticipating and acting on an ever-changing environment are also crucial. It is clear, however, that there are multiple established traditions of anticipation and future-oriented action, all with recognizable conceptions of futures literacy. There are, in short, multiple futures literacies, or at least multiple forms of futures literacy.

In this paper, we zoom in on the multiplicity of the term futures literacy. We argue that a key component of being futures literate is reflexivity: a critical awareness of different attitudes toward the future, including what can be known about it, how it affects the present, how to study and measure it, and how to create pathways for action. An important element of such a reflexive futures literacy is an awareness of the multiple, often implicit interpretations of futures literacy, and how these are in constant conversation about different ways to 'use the future'. By showing how different traditions have different implicit and explicit perceptions of futures literacy, we aim to add to the debate on futures literacy by calling for a reflexive understanding of how particular conceptions of the future take shape and take hold, including the role that power plays in this process, to increase the futures literacy of different strands of futures studies themselves.

We suggest, then, that to be futures literate starts with being literate about what attitudes toward the future exist and what the power dynamics are, with being reflexive about one's own attitude toward the future, and with being aware of what other attitudes toward the future might have to offer. For purposes of clarity, in this article we suggest that futures are always plural but that there are analytically coherent attitudes toward 'the' future. As such, we speak about futures (plural) whenever it concerns the plurality of possible future worlds (and the plurality within any given future) and about the future (singular) whenever we refer to the intellectual relationship to 'the future'.

The paper is structured as follows: The next section elaborates on different epistemological and even ontological points of departure for futures approaches, and connects this to futures literacy. The third section of the paper highlights approaches to the future that we argue are currently underrepresented but crucial for futures literacy. The fourth section proposes the concept of reflexivity as a way to consider various approaches to the future more critically and select ways of engagement that are fit-for-purpose. We end the paper with a conclusion and some proposed avenues for future research into reflexive futures literacy.

## 2. Approaches to futures literacy

In the governance literature, various intellectual traditions make their own epistemologically and even ontologically distinct claims about the future and its manifestations in the present (Andersson, 2018; Muiderman, Vervoort, Gupta, & Biermann, 2020). These claims range from studies of the performativity of imagined futures (Beckert, 2016), sociotechnical imaginaries (Jasanoff & Kim, 2015), futures-in-the-making (Groves, 2017), futuring (Oomen, Hoffman, & Hajer, 2021), and expectations (Borup, Brown, Konrad, & van Lente, 2006; Van Lente, 2012) to investigations of 'futures-in-the-making' and their discursive-material enactment (Adam & Groves, 2007, 2011; Groves, 2017; Tutton, 2017), and proactive attempts to adequately prepare for the future in terms of governance (Guston, 2014; Muiderman et al., 2020), design (Bendor, 2018; Candy & Dunagan, 2017), transitions (Geels & Schot, 2007; Grin, Rotmans, & Schot, 2010), and transformations (Hebinck, Vervoort, Hebinck, Rutting, & Galli, 2018; Wolfram, 2016). As a result of their different outlooks on analyzing, understanding, and influencing the future, these diverse approaches have fundamentally different attitudes to how the future should be treated—and what it means to meaningfully engage with the future. As such, they also hold different conceptions of what it would mean to be literate about the future. Most recognize, however, that it is deeply important to engage with the future as such, because people's actions are always in some way anticipatory—and in that sense always future-oriented (e.g., Bell, 2004; Bergman, Karlsson, & Axelsson, 2010; Miller, 2018; Vervoort & Gupta, 2018). Indeed, as Arjun Appadurai has shown, such an orientation toward the future is also evident among the world's poorest, such as in the capacity of Indian slum-dwellers to aspire to imagined futures (Appadurai, 2004, 2013).

As Jenny Andersson (2018, p. 4) observes, futures research is always "*an intervention into the present and an attempt to shape coming times through the creating of manifold technologies, devices, and forms of future experience*". This means that interpretation of futures literacy always depends on the kinds of interventions made in the present, and how future times are imagined to be shaped. In literacy pedagogy, for example, literacy is considered a tool for the understanding and joining of discourses. Cope & Kalantzis (2009) describe the development of literacy as the creation of "*active designers of meaning*". In their work on multiliteracies, they describe literacy as a deeply constructivist practice: "*each meaning maker designs the world afresh in a way which is always uniquely transformative of found meanings; and then leaves a representational trace to be found by others and transformed once again*" (Cope & Kalantzis, 2009, p. 20). Futures literacy is, likewise, the capacity to 'use the future' in various ways (Miller, 2018). Two questions feature centrally in such a view on futures literacy: Firstly, what is the future? And secondly, what methods do we use to 'know the future'?

Despite the fact that people always base their actions, both individually and collectively, on some conception of the 'later-than-now' (Miller, 2018), these questions are often overlooked. What anthropologist Arjun Appadurai (2004) has called 'the capacity to aspire', the ability to imagine and strive toward a life or society different from one's present situation, is typically an implicit

phenomenon rather than a process in which people are “*active designers of meaning*” (Cope & Kalantzis, 2009). As Riel Miller notes, “*people’s fictions about the later-than-now and the frames they use to invent these imaginary futures are so important for everyday life, so ingrained and so often unremarked, that it is hard to gain the distance needed to observe and analyse what is going on*” (Miller, 2018, p. 2).

Futures literacy addresses the capacity to reflect on such questions and the capacity to empower a more deliberate engagement with futures. In doing so, futures literacy as a concept tries to open up questions of the future both to a wider set of actors and to a wider set of questions. It offers a framework and corresponding social technologies that can acquaint people with thinking about the future and the choices made. We argue that in order to be successful, futures literacy needs further recognition of the many different possible answers to Miller’s (2018) questions: ‘what is the future?’ and ‘what methods do we use to know the future?’ Futures literacy and, by extension, futures education can never be disentangled from normative and political commitments toward the future. As such, it is important to understand how different attitudes toward the future will influence what it means to be futures literate. We argue that futures literacy should be contextualized not just geographically or economically, but also epistemologically and ontologically, especially if the aim is to expand the range of possible futures. Comprehending how particular answers to Miller’s (2018) questions shape the space for engaging with futures, and how certain methodologies and epistemologies open up or narrow down a particular range of what is possible and imaginable, is a crucial step on the path toward futures literacy. It will also help to understand and improve anticipatory systems and processes and contribute to the design of anticipatory approaches that are suited to their respective purposes.

A useful point of departure for this epistemological and ontological contextualization is the framework suggested by Muiderman et al. (2020), which investigates how different intellectual traditions approach the two questions posed by Miller (2018). Through a literature review with the notion of ‘anticipatory governance’ at the center, the authors categorize a diverse set of relationships to the future in different futures practices. These different approaches to the future are categorized according to three core aspects: “(i) *assumptions about the future*, in particular assumptions about the knowability and manageability embedded in the approach; (ii) the implications for *actions to be taken in the present*; and (iii) the *ultimate aim of engaging in/with anticipatory governance*” (Muiderman et al., 2020). This leads to a framework comprising four approaches, each with their own epistemology and tools. The paper points out that the same methods and tools are often used across different approaches to attitudes toward futures, resulting in very different framings of their processes and results. The first approach assumes that the future is at least partly knowable. The accompanying tools and methods consist of planning mechanisms and models to determine the probabilities of certain futures unfolding, including low-probability but high-impact futures, with the aim of mitigating risks. The second approach sees fundamental uncertainty in predicting any future, and thus prefers to conceptualize multiple plausible future pathways in order to test adaptive capacities in a future-oriented fashion. These approaches include a portfolio of quantitative models, participatory scenario development, strategic planning, and horizon scanning. A third way of engaging with the future aims to open up alternative future pathways through collectively imagining multiple futures, using design, gaming, and other experimental and experiential interventions geared toward co-creation. Lastly, a tradition of critical deconstruction and analysis interrogates engagements with ‘the future’ by questioning how visions of and imaginaries for the future take hold and assessing their political implications.

These four approaches present fundamentally different epistemological and even ontological points of departure—and various implications for what it means to be futures literate. The first two approaches, though distinct, are more focused on reacting to contextual futures, either by predicting and mitigating risks (approach 1, which we will refer to as “predictive”) or reflexively navigating plausible futures (approach 2, which we will refer to as “plausible”). In a sense, these engagements with the future rely on being literate *about what the future may hold*. The third and fourth approaches have different aims. Instead of asking what the future may hold and how one might react to that future, these approaches take a deeply constructivist view of the future, where being futures literate specifically relates to being aware of *how the future is constructed in the present*. The third approach, which we will refer to as “experimental” for the purposes of this paper, aims at the collective co-creation of new futures—seeking to expand, through collective experimentation, engagement, and imagination, the range of futures imagined as possible and/or desirable, often focusing on how such futures can become present-day reality. Similarly constructivist, the fourth approach, which we will refer to as “critical”, takes a more analytic view, scrutinizing imaginaries in order to shed light on their political implications.

A key point here is that these different approaches do not only have different interpretations of what it would mean to be futures literate—they are also often unaware of (or at least unreflexive about) other approaches. Often, futures researchers are not explicitly aware of how their mode of engagement with the future differs from others’, because many of the differences and disagreements emerge from implicit assumptions about the world rather than explicit methodological investigation (Vervoort & Gupta, 2018). This makes it difficult for futures practitioners from different backgrounds to ‘read’ or decode each other’s work. As a result, disagreements may remain unclear or obscured because fundamental assumptions do not surface. For non-researchers, such as policy makers, organizations who shape society and various markets and sectors (Grin, 2006), and private individuals, these differences can make futures literacy a prohibitively difficult aim. Literacy about the various ways to engage with the future is further complicated by the fact that, as Muiderman et al. (2020) recognize, these epistemological and ontological positions on futures do not enjoy equal representation in on-the-ground anticipatory practices.

In future-oriented fields of research, the majority of anticipatory practices have focused on mapping out probabilities or predicting a set of futures. Engaging with the need to navigate deep uncertainties in a more adaptive, constructivist way also happens, but less often, especially in fields dominated by technological discussions, like climate engineering (Low & Schäfer, 2019; Oomen, 2021). Imaginative and experimental futures approaches have received significantly less attention, or have been limited to exclusive, top-down, and often deeply commercial engagements with desired futures. Critical investigations of imagined futures are often contained within academia and rarely seek to actively impact societal futuring. This under-representation of both experimental and critical futures approaches, and to a lesser degree of approaches that focus on navigating uncertainty in practice, can have many

different causes depending on context and scale—such as a lack of resources (Vervoort et al., 2014), lack of knowledge of alternative futures interventions (Carolan, 2016), or an epistemological preference for quantitative projections (Ezrahi, 1990; Low & Schäfer, 2019; Porter, 1995; Rijkens-Klomp, 2012)—and is often also due to the fact that they do not fit larger cultural assumptions about valuable knowledge and decision-making (Stoll-Kleemann, Riordan, & Burns, 2003).

Experimental and critical approaches open up futures to creativity, radical change, and critical reflection, making possible a more varied and reflexive view of what the future is and how to engage with it (Oomen et al., 2021). In their seminal article on wicked problems, Rittel and Webber (1973) describe how a solution for these undefined, complex social-policy problems can only emerge from a collective argumentation process. This emphasis on sense-making, as Hoffman et al. (2020) term it, is reflected in the “weaving” process that Cope and Kalantzis (2015) describe in their pedagogy of multiliteracies. This process of collective meaning-making moves backwards, forwards, and across acts of experiencing, conceptualizing, analyzing, and applying. While probabilities and prediction suit the purposes of practitioners presented with non-wicked problems, the power of prediction decreases as the time horizon and complexity increase (Swart, Raskin, & Robinson, 2004). Approaches that recognize this challenge embrace deep uncertainty, but run the risk of remaining merely adaptive, rather than transformative, by downplaying the constructive political agency inherent in the crafting of futures. Futures literacy requires a far more imaginative and reflexive understanding of what the future is and could be—and especially an awareness of and reflexivity about this multiplicity of possible approaches to the future.

In recent years, this recognition has grown both within and outside of academia. In design studies, Morrison et al. (2020: 115) describe design as “*having shifted away from a techno-modernist design solutionism and to how it may engage in shaping futures through experimentation and exploration in the critical and productive engagement with techno-cultural life*”. Practitioners and academics in traditionally more quantitative futures disciplines, such as scenario modelling, have made considerable efforts to include more speculative, imaginative, and participatory elements in their processes (Kok, van Vliet Mathijs, Bärlund Ilona, Dubel, & Sendzimir, 2011; Mason-D’Croz et al., 2016). These developments fulfill an important condition of futures literacy: a blend of methods and hybrid approaches (Miller, 2007). For large and complex problems, however, this expansion has not been able to fully bridge the knowledge-action gap or the value-action gap: the divides that exist between the knowledge that people gather to form their futures practices, and how they process and act on this knowledge (Bendor, 2018; Blake, 1999). Furthermore, the context and staging of futures are still largely undervalued (Hajer & Pelzer, 2018; Oomen et al., 2021). What Grin (2006, p. 60) described as the “*Aristotelian notion of metis: the craft to take contextual conditions into account*” is still a futures studies blind spot.

To increase futures literacy, there is space for both academics and practitioners to clarify the fundamental aims and assumptions of futures work. In addition to this, measuring and reflecting on the outcomes of any futures endeavor is key to anticipatory practices that are fit-for-purpose. As Miller (2007) indicates in his argument about the necessity for hybrid methods and approaches, futures literacy necessarily entails being literate about which approach serves which purpose. Only based on literacy about different epistemological and ontological points of departure can such hybridity be achieved in any meaningful way. The predominance of quantitative projections that, in the words of Andy Stirling (2008) “*close down*” the range of options for the future—and, correspondingly, the underrepresentation of qualitative, interpretative methods—leads anticipatory practices, including governance and education, to focus on futuring tools that may not serve their intended purpose. In the remainder of this article, we argue for a reevaluation of qualitative, interrogative, and explicitly imaginative futures methods, in order to clarify how and when certain epistemological and ontological approaches to the future are fit-for-purpose. Central to this attempt are embedded notions of agency and structure, as well as the extent to which the future can be shaped by deliberate action in the present.

### 3. Broadening the concept of the future

In this section, we aim to analyze recent developments in speculative and critical futures, and draw lessons from them to make the futures field more reflexive and thus deepen what it means to be futures literate. As Jenny Andersson states, engaging with futures is always also “*an intervention into the present*” and “*an attempt to shape coming times*” (Andersson, 2018, p. 4). Rather than looking at futures research as an attempt to project or predict the future most accurately, we see futures research as a way in which actors shape both the present and the ‘later-than-now’. In such a view, approaches to the future are not simply tools for making accurate predictions or facilitating new visions for the future, but rather “*Techniques of Futuring*”: “*practices bringing together actors around one or more imagined futures and through which actors come to share particular orientations for action*” (Hajer & Pelzer, 2018, p. 225). From this perspective, while the different approaches to the future may have different tools and artefacts, their practices can still be compared as practices that bring people together around particular imagined futures (Oomen et al., 2021). The central insight of such a constructivist lens on ‘futuring practices’, shared by historians (Andersson, 2018; Warde & Sorlin, 2015), sociologists (Beckert, 2016; Borup et al., 2006), and anthropologists (Appadurai, 2013), is that the main social function of imagined futures and the tools/approaches that construct them is their capacity to inform meaning and stimulate action and guide choices in the present. This means that although the accuracy of certain visions of the future, such as climate models and economic projections, is (typically but not always) important for public trust in them, their primary social function is bringing people together around particular orientations for action—not describing the most accurate future. The four futures approaches outlined by Muiderman et al. (2020) make different claims about the future, but their claims still aim to fulfill a social role in bringing people together around certain images of and for the future.

Reflexive futures literacy, in our view, should include a recognition of this social function of images of the future and, importantly, the implications that the different types of approaches to the future have for acting on the future—and an ability to reflect on the different conceptions of futures literacy that might result from such different approaches. ‘What is the future?’ (Urry, 2016) is never a question with a clear answer, because the future ‘has not taken material form in the present time’ (Tutton, 2017, p. 4). Because “*there*

are no future facts” (Brumbaugh in Bell & Mau, 1971, p. 9), the future is real only to the extent to which present alternatives or possibilities for the future are real (Bell & Mau, 1971). The main function, then, of the future is as an approach for action in the present, as Riel Miller (2018) also recognizes when he observes that imaginary futures and anticipation are an integral part of acting in the present. Recognizing the primarily imaginary function of the future does not of course mean that the future is irrelevant or immaterial. Anticipations of climate change, for example, fundamentally weigh on the present—and show clearly that the present also weighs, increasingly heavily one might add, on the future. But it does mean that futures literacy depends to a great extent on being able to distinguish between different types of imaginary futures and how those futures come into being, as well as the reflexive capacity to reflect on how futures imagined differently also lead to different outcomes—and different literacies. As outlined above, the four futuring approaches—probability-focused projections, engaging with uncertainty through multiple comparative pathways, experimental opening up of imaginative alternatives, and critical deconstruction of imagined futures—clearly have different tools and practices that bring people together around particular imaginary futures. Simply put, they have different social mechanisms that bring people together, and as such they have different social functions. So what are the social functions (by and large) of futures approaches, and how do they relate to futures literacy?

*Predictive futures approaches* focus on understanding the likelihood of different future eventualities, including low-likelihood but high-impact futures. The social function of this approach to engaging with futures could be described as providing planners with a better grip on the future—and, arguably, inspiring confidence in plans and strategies, and in those proposing them, by identifying risks and finding ways to mitigate them. Futures literacy in this approach consists of the ability to understand/be able to interpret, as well as apply, quantitative approaches for scenario projection and the estimation of likelihoods associated with different scenarios (Muiderman et al., 2020).

*Plausible futures approaches* embrace the future as deeply uncertain, and widely divergent scenarios as plausible within bounded structures. Socially, this approach brings people together around a collective anticipatory capacity as a part of their overall adaptive capacity. Together, this group explores new futures that challenge previous assumptions about what might happen. It supports the collective investigations of organizational blind spots and strengths, opportunities for investment in new skills and capacities, and the need to establish buffers and back-up plans, giving organizations and communities a sense of being able to prepare for the future. The focus here is on practicing with futures (Guston, 2014). Futures literacy, as interpreted by this type of approach, means systems thinking—being able to understand how a multitude of drivers co-produces challenging and complex futures. The systems thinking lens is also applied to organizations and communities themselves, which are to be understood as adaptive systems in a changing context (Williams, Kennedy, Philipp, & Whiteman, 2017). Furthermore, futures literacy means being comfortable with deep uncertainty (Maier et al., 2016). Finally, it means being able to re-perceive the present through the eyes of many challenging futures (Wack, 1985).

*Experimental futures approaches* interventions aim to generate shared realities that have mobilizing power in the present. Their imaginative practices bring people together around novel futures that, once envisioned, can orient people toward the actions needed to bring such futures about. Bringing people together around such newly imagined futures is a social and political process, in continuous competition with the presence of more dominant imagined futures and the sociopolitical structures that reenact them. Experimental futures practices often center around bringing together novel groups and mixes of societal actors, especially including those involved in new niches or ‘seeds’ of new futures (Bennett et al., 2016). Futures literacy from an experimental futures perspective means individual and collective imaginative power, the capacity to generate new realities and to inspire acts of imagination in others. Futures literacy in this mode also means the recognition that dominant futures are constructed, that they can be replaced, and that alternative futures are always waiting to be born—to recognize the “*evolutionary potential of the present*” (Snowden, 2011, p. 223). It is ‘worldmaking capacity’ (Vervoort, Bendor, Kelliher, Strik, & Helfgott, 2015). It also means an ability to think about concrete change pathways (Hebinck et al., 2018)—to understand how transformations and transitions have been demonstrated to happen and may be possible in the future (Feola, 2015).

*Critical futures approaches* do not presuppose an active, formative engagement with the future as such, but rather bring people together around a reflexive deconstruction of images and imaginaries of the future. In doing so, critical interventions demystify, denaturalize, and historicize imagined futures, showing how ideas about plausibility, desirability, and probability are not self-evident or natural. Rather, they are the result of social processes (e.g., Beck & Mahony, 2018; Beck & Oomen, 2021), deliberate interventions (Hajer, 2017; Hajer & Pelzer, 2018), power distributions (Stirling, 2018), and existing collective imaginations about both the future and the social fabric of society (Jasanoff & Kim, 2015). As such, critical engagements with the future open up the ‘black box’ that naturalizes particular visions of the future—rendering them available for critical scrutiny. Socially, this critical scrutiny makes room both for alternative futures, such as those provided by experimental interventions, and for reflection on the assumptions that make up the interventions aimed at predicting futures or mitigating uncertainty.

While all four types of future making and future-oriented investigation can be useful, they are not equally applicable in all circumstances. Projections might be able to extrapolate current trends accurately, and even convince their audience of the inevitability of their projected futures, but they typically cannot meaningfully incorporate radical ruptures or cultural sea changes. Normative explorative futures, on the other hand, can imagine possible future worlds but often lack the sort of extrapolative rigor that projections have. Both are important. Futures literacy at a level that recognizes and can engage with these different approaches to futures work, across the board, is precisely so important because it teaches practitioners, scientists, and policymakers, as well as others, to think critically about what types of imagined futures are fit for what and whose purpose, and to appreciate its respective power-effects. As the 21st century calls for major and rapid system changes across the board—the recent COVID-19 pandemic is the most charismatic example, but climate change and other forms of environmental degradation are others—the question of what practices inform planning and governance around the world is increasingly pertinent. It is clear that 20th-century methods of projection and planning

do not hold up particularly well in light of a search for systems change. Rather, there is a need for emergent and innovative approaches to the future that can both question current systems and roadmap needed changes.

Understanding futures literacy as the ability to relate to different attitudes toward the future can also be used to reflect on a strand of futures work that complements and combines different approaches to the problem of the future. Imaginative exercises and experimentation can be combined with the projective scientific rigor of predictive approaches or deep uncertainty to make transformative imagined futures socially persuasive. In such a process, highly speculative or imaginative futures are given more credence by relying on deeply embedded social technologies that are tailored for specific purposes. Such deliberate use and recombination of different types of futuring can be used to identify points of improvement and to spark creative new ideas. In such recombinations, explorative experimental futures interventions can be used to give a social life and imaginative existence to the type of projections characteristic of predictive futures approaches, predictive interventions can function as legitimation for particular imagined futures, and plausible scenarios can be used in service of an improved overall experimental approach. There are many possibilities and a large potential for combining different types of futuring (e.g., Hebinck et al., 2018; Kok et al., 2011; Vervoort et al., 2014). Such hybrid futuring demands a reflexive futures literacy from participants in the form of the ability to switch between more context-focused and more vision-focused modes of engagement.

Hajer and Pelzer (2018) illustrate this idea with the case of '2050: An Energetic Odyssey', an audiovisual installation depicting all energy for the Netherlands coming from turbines in the North Sea. This intervention was carefully staged, with a handpicked audience of high-level actors from business and policy making present in a curated environment. For the intervention, the authors built on Shapin & Schaeffer's (1985) famous insights about how a 'crucial experiment' can create a shared moment that brings people together around a shared norm or, in the case of the Energetic Odyssey, an imagined future. The goal of such an intervention, then, is to facilitate 'reality effects' (Ezrahi, 2012) that suspend the disbelief people have about particular imagined futures by presenting new knowledge strategically—by fostering a collective belief in these imagined futures. In recent years, many interventions have attempted to foster such moments in the hope of opening up new possibilities for imaginaries of the future through experiential futures. Some examples are the use of future generations in decision-making processes at the local government level (Kamijo, Komiya, Mifune, & Saijo, 2017); mapping a pre-collapse society (Candy & Dunagan, 2017); and exploring water management futures under climate change in a game (Van Pelt et al., 2015). Most of these experiential futures interventions have an open-ended nature that allows for speculation and more associative imagining of many different futures. In this open-endedness, based on a reflective reading of the present, these interventions are an outflow of what Ulrich Beck (1992), John Giddens, and Scott Lash (Beck, Giddens, & Lash, 1994) called a reflexive modernity (Grin, 2006). They allow for reconsideration and course-correction of a planned pathway or imaginary through making these projections of the future their own theme. This reflexivity is also visible in the examination of the outcomes of futures interventions. In classic scenario or visioning workshops, it is possible to end the workshop with a specific plan, and to track that plan along its eventual execution. Reflexive speculative or creative futures interventions are more multifaceted and differ every time, which makes it difficult to reflect on their outcomes or even impacts.

The ambiguity of outcomes and difficulty in reporting on them is a barrier for these practices to being widely adopted in governance and planning processes. Hajer and Pelzer (2018) use a discourse analysis, tracking the expressions and pledges of funding made by their audiences in the media after their intervention. The outcomes of even more speculative interventions are often only anecdotally reported (Candy & Dunagan, 2017). Their contributions in terms of speculation, testing, experimenting, and critical reflection on such interventions, however, are also important elements of futures and arguably of governance and planning processes. This becomes even more pressing in the face of present-day large and uncertain economic, environmental, and social changes such as the energy transition at the center of the '2050: an Energetic Odyssey' case. Key to finding a futures approach that is fit-for-purpose is the identification of the desired contribution to a process. This depends on the aim of the process, but also the stage and the people involved. Adapting Rijke et al.'s (2012, p. 76) definition of fit-for-purpose governance, we can define a fit-for-purpose futures approach as "a measure of the adequacy of the functional purposes that futures practices have to fulfil at a given point in time". Finding the purpose of a futures approach is crucial, both to get to a desired outcome and think about a diverse range of possible futures.

#### 4. Futures literacy as reflexivity

Understanding futures literacy as the ability to relate to different attitudes toward the future can help foster a more general reflexivity about futures and the effect of specific futuring interventions. Experimental and critical futures work is important precisely because it interjects such reflexivity into the debate about the future. Reflexivity about the effect of particular futuring interventions is crucial, because imagined futures have power. They coordinate and structure action in the present, thereby giving a particular shape to the future also (Beckert, 2016; Jasanoff & Kim, 2015). Experimental and critical approaches open up the possibility to not only analyze more explicitly the politics of the future by investigating how certain actors exercise the power of the imagination over others, but also how such power shapes the future. The power to determine how people think about the future, what is conceivable and what is not, is, arguably, the highest form of power. It bestows, in the famous words of Steven Lukes (1974), "ideological power": the power to shape people's wishes and desires. It shapes, moreover, people's imaginative perceptions of power and normalcy, embedding tacit collective imaginations that organize the world (Ezrahi, 2012; Taylor, 2004). The fact that so many people think that the future of mobility is all about self-driving cars, for example, might say just as much about corporate power to shape imaginations of the future as it says about what is a plausible future, let alone a desirable future. Reflexive concepts such as the techniques of futuring concept (Hajer & Pelzer, 2018; Oomen et al., 2021) analyze the social life of futuring interventions. Similarly, a concept like anticipatory governance is explicitly framed as focusing on futures as a site for politics (Vervoort & Gupta, 2018). Such concepts allow for an understanding of how ideological power over the future is exercised by different actors at different times. Categorizations such as those proposed by

Muiderman et al. (2020) paint a comprehensive picture of the futures field and the various existing epistemologies and approaches. Moreover, raising the question ‘whose literacy?’ also allows us to think about who particular traditions of futures work are organized and optimized for. Deeply quantitative approaches ‘fit’ within a policy-making context (Low & Schäfer, 2019; Rijkens-Klomp, 2012); commercials and advertising are tuned toward the general public and shape their ‘fictional expectations’ (Beckert, 2013). Likewise, we can discern a predilection for the mobilization of the arts via biennales, installations, or performances in museums or public space in the more experimental and critical traditions (Pelzer & Versteeg, 2019).

It is precisely because the power to shape the future ideologically is so great that reflexivity about what types of futures the different approaches portray and circulate is important. Different types of futuring have different specific effects on the types of futures that are collectively imagined and worked toward. Some open up different spaces for action, while others narrow down the range of action (Stirling, 2008). Opening up or closing down futures is always a political act, because it always entails a certain distribution of power and resources—and presupposes a form of ideological power. This means that questions about how to open up and close down futures are always crucially important. A reflexive futures literacy can foster awareness about images of the future, and (importantly) also the ways in which such futures are produced and performed. A reflexive futures literacy, then, embraces the shaping effect of different approaches to future-oriented action, turning our attention not only to futures *as they are presented*, but also to ‘futures-in-the-making’ or *futures as they are made*. In doing so, it can facilitate a form of literacy that can critically reflect on what types of futuring interventions and knowledges about the future are necessary.

According to Brian Wynne (1993, p. 321) reflexivity can be defined as the “*systematic processes of exploration of the prior commitments framing knowledge*”. Salmon, Priestley, and Goven (2017, p. 58) expand this definition by adding an explicitly active component in the “*informed capacity to critically analyse one’s underlying assumptions, expectations, and positioning in relation to one’s involvement in outreach. It is not simply an internal thought process, but rather a type of thinking tied to action. Reflexive thinking makes possible ways of acting that would not otherwise be possible*”. Reflexivity, as precisely such an active mode of critically analyzing both the underlying assumptions and the effects of futuring approaches and images, can present an antidote of sorts to a linear way of thinking in which uncertainty is eliminated through ever more data and expert knowledge, much like John Grin envisions reflexivity in relationship to governance (Grin, 2006). This builds on the idea of reflexive modernization proposed by Beck, Giddens & Lash (1994), who argued that a focus on the elimination of uncertainty has left institutions with blind spots for risk and externalities. This lack of reflexivity can lead to a hubristic and narrowly technocratic relationship with the future (Jasanoff, 2003) due to a homogenization of processes and the omission of local specificity at the cost of taking into account contextual factors (Grin, 2006). This comes at great potential cost environmentally, technologically, and societally (Hajer et al., 2015). Such blinkered visions are a form of ‘futures illiteracy’ that can be overcome by institutions and individuals that self-critically review their own prior, tacit commitments. Commitments that would need to be questioned could include visions of control and a technological fix, economic competitiveness, or the idea that technoscientific innovation as such will induce social progress (Braun & Kropp, 2010; Kuhlmann & Bogumil, 2018). Used in such a way, reflexivity can present a way to move beyond an “*unstructured pluralism*” that construes “*scientific reliability and social legitimacy as distinct requirements that have to be pursued in parallel and traded off against each other*” (Popa, Guillermin, & Dedeurwaerdere, 2015, p. 46). This means that reflexivity does not mean postmodern unmooring but rather a way to steer very precisely into the desired direction (Grin, 2006).

Futures literacy interpreted at least in part as reflexivity can strengthen both particular engagements with the future in any given approach and the capacity to engage with the later-than-now in principle. In doing so, it can also help one assess what types of knowledge about or visions of the future are fit for the purpose they serve in particular problem situations. When, for example, does it make sense to project certain environmental futures, and when are more open-ended, explicitly democratic forms of futuring more applicable, more likely to lead to beneficial and just futures? And what types of images and future-oriented action are now predominant in society, and why? Reflexivity can also help to address meaningful recombinations of futuring approaches, by merging, for example, hard natural boundaries with reflexive and open-ended deliberations and visions of the future. An institutionalized form of reflexivity can also strengthen all four approaches to futures engagement themselves. For purposes of prediction, reflexivity can help see the limits, blinkered visions, and historical contingencies of models and projections, as well as potential problems created by the ways in which this approach of futuring might reinforce status quo thinking. For navigating uncertainty, reflexivity may help see blind spots and a lack of inclusivity in futures processes. More fundamentally, it can help identify the problems with an adaptive, and therefore reactive rather than transformative, stance toward the future. For more open-ended experimentation, reflexivity may help identify where the transformative and generative impulse of this type of futures engagement may create its own blindness to contextual challenges. For critical futures, whose entire engagement with the future revolves around reflexive criticism, a reflexive futures literacy can motivate a constructive engagement with the future that can help steer into the future clear-eyed, with a keen sense of power distributions and normative commitments. A reflexive futures literacy, then, can help people engage and span different types of future-making, can aid inter- and transdisciplinary collaboration between different types of futuring, and can address the ideological power that goes into shaping the later-than-now.

## 5. Conclusion

Futures literacy is increasingly important in a rapidly changing world in which the weight of the future on the present is increasing as a result of environmental fears and the immediacy of pandemics—as is the weight of the present on the future through technological and environmental change. Beyond asking ‘what is the future?’ and ‘how can we anticipate and interact with the future?’ it is also important to keep asking ‘what is futures literacy?’

From our analysis, we can draw two main conclusions about reflexive futures literacy. Firstly, reflexive futures literacy includes

being able to articulate the differences between different types of futuring, being aware of the social and imaginative effects of particular futuring practices, and being able to reflect on what types of futuring are fit for what type of purpose. This extends to institutions and policy as well as individuals. Secondly, and possibly more importantly, reflexive futures literacy facilitates asking the right questions at the right time, ensuring that our understanding and collective sense-making of the future is informed by the right metrics, careful staging, and the right type of ideological power. Reflexive forms of futures literacy, regardless of the approach and tradition they exist in, explicitly acknowledge that power, and are able to deliberately but sensitively steer images of the future in empowering—and ideally also environmentally-friendly and democratic—ways.

Several questions for further research can aid the development of reflexive practices for the engagement with futures:

- *What assumptions, values, and worldviews underlie our relationships with the later-than-now?*
- *What approaches exist to make sense of the future? How and when are they used? How and when should they be used?*
- *How can we understand and evaluate how futures approaches change relationships with the later-than-now?*
- *How can predominant ideas about and conceptions of the later-than-now be challenged? By whom, how, where, and when?*

Reflexivity in futures literacy consistently asks how we understand, anticipate, and act on the future, how this frames and shapes the world we live in, and how we ascribe meaning to our actions in the present. This allows for a more diverse and holistic range of futures, images of which can guide decisions in the present.

## References

- Adam, B., & Groves, C. (2007). *Futures matters: Action, knowledge, and ethics*. Leiden: Brill.
- Adam, B., & Groves, C. (2011). Futures tended: Care and future-oriented responsibility. *Bulletin of Science, Technology & Society*, 31(1), 17–27.
- Andersson, J. (2018). *The future of the world: Futurology, futurists, and the struggle for the post-Cold War imagination*. Oxford: Oxford University Press.
- Appadurai, A. (2004). The capacity to aspire: Culture and the terms of recognition. In V. Rao, & M. Walton (Eds.), *Culture and public action* (pp. 59–84). Palo Alto: Stanford University Press.
- Appadurai, A. (2013). *The future as a cultural fact: Essays on the global condition*. London, UK: Verso.
- Beck, S., & Oomen, J. (2021). Imagining the corridor of climate mitigation – What is at stake in IPCC’s politics of anticipation? *Environmental Science and Policy*, 123, 169–178. <https://doi.org/10.1016/j.envsci.2021.05.011>.
- Beck, U. (1992). *Risk society: Towards a new, odernity*. London: Sage.
- Beck, S., & Mahony, M. (2018). The IPCC and the new map of science and politics. *Wiley Interdisciplinary Reviews: Climate Change*, 9(6).
- Beck, U., Giddens, A., & Lash, S. (1994). *Reflexive modernization: Politics, tradition and aesthetics in the modern social order*. Stanford, CA: Stanford University Press.
- Beckert, J. (2013). Imagined futures: Fictional expectations in the economy. *Theory and Society*, 42(3), 219–240. <https://doi.org/10.1007/sl>.
- Beckert, J. (2016). *Imagined futures: Fictional expectations and capitalist dynamics*. Cambridge, MA: Harvard University Press.
- Bell, W. (2004). *Foundations of futures studies: Values, objectivity, and the good society*. New Brunswick, NY: Transaction Publishers.
- Bell, W., & Mau, J. A. (1971). *The sociology of the future*. New York: Russell Sage Foundation.
- Bendor, R. (2018). *Interactive media for sustainability*. London: Palgrave Macmillan.
- Bennett, E. M., Solan, M., Biggs, R., McPhearson, T., Norström, A. V., Olsson, P., ... Xu, J. (2016). Bright spots: Seeds of a good Anthropocene. *Frontiers in Ecology and the Environment*, 14(8), 441–448.
- Bergman, A., Karlsson, J. C., & Axelsson, J. (2010). Truth claims and explanatory claims: An ontological typology of futures studies. *Futures*, 42(8), 857–865. <https://doi.org/10.1016/j.futures.2010.02.003>.
- Blake, J. (1999). Overcoming the ‘value-action gap’ in environmental policy: Tensions between national policy and local experience. *Local Environment*, 4(3), 257–278. <https://doi.org/10.1080/13549839908725599>.
- Borup, M., Brown, N., Konrad, K., & van Lente, H. (2006). The sociology of expectations in science and technology. *Technology Analysis & Strategic Management*, 18(3/4), 285–298.
- Braun, K., & Kropp, C. (2010). Beyond speaking truth? Institutional responses to uncertainty in scientific governance. *Science, Technology and Human Values*, 35(6), 771–782. <https://doi.org/10.1177/0162243909357916>.
- Candy, S., & Dunagan, J. (2017). Designing an experiential scenario: *The People Who Vanished*. *Futures*, 86, 136–153. <https://doi.org/10.1016/j.futures.2016.05.006>.
- Carolan, M. S. (2016). Adventurous food futures: Knowing about alternatives is not enough, we need to feel them. *Agriculture and Human Values*, 33(1), 141–152. <https://doi.org/10.1007/s10460-015-9629-4>.
- Cope, B., & Kalantzis, M. (2009). “Multiliteracies”: New Literacies, new Learning. *Pedagogies: An International Journal*, 4(3), 164–195. <https://doi.org/10.1080/15544800903076044>.
- Cope, B., & Kalantzis, M. (2015). The things you do to know: An introduction to the pedagogy of multiliteracies. In B. Cope, & M. Kalantzis (Eds.), *A pedagogy of multiliteracies*. London: Palgrave Macmillan.
- Emirbayer, M., & Mische, A. (1998). What is agency? *American Journal of Sociology*, 103(4), 962–1023. <https://doi.org/10.1086/231294>.
- Ezrahi, Y. (1990). *The descent of Icarus: Science and the transformation of contemporary democracy*. Cambridge, MA: Harvard University Press.
- Ezrahi, Y. (2012). *Imagined democracies: Necessary political fictions*. Cambridge, UK: Cambridge University Press.
- Feola, G. (2015). Societal transformation in response to global environmental change: A review of emerging concepts. *Ambio*, 44(5), 376–390. <https://doi.org/10.1007/s13280-014-0582-z>.
- Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, 36(3), 399–417.
- Grin, J. (2006). Reflexive modernization as a governance issue. In J.-P. Voss, D. Bauknecht, & R. Kemp (Eds.), *Reflexive governance for sustainable development* (pp. 57–81). Cheltenham: Edward Elgar Publishing.
- Grin, J., Rotmans, J., & Schot, J. (2010). *Transitions to sustainable development: New directions in the study of long term transformative change*. Abingdon-on-Thames: Routledge.
- Groves, C. (2017). Emptying the future: On the environmental politics of anticipation. *Futures*, 92, 29–38. <https://doi.org/10.1016/j.futures.2016.06.003>.
- Guston, D. H. (2014). Understanding ‘anticipatory governance’. *Social Studies of Science*, 44(2), 218–242.
- Hajer, M. A. (2017). The power of imagination. *Inaugural lecture on the occasion of the acceptance of the distinguished professorship in “urban futures”*. Utrecht: Utrecht University. <https://doi.org/10.1177/097194580200500207>.
- Hajer, M. A., & Pelzer, P. (2018). 2050—An Energetic Odyssey: Understanding “Techniques of futuring” in the transition towards renewable energy. *Energy Research & Social Science*, 44, 222–231.
- Hajer, M., Nilsson, M., Raworth, K., Bakker, P., Berkhout, F., De Boer, Y., ... Kok, M. (2015). Beyond cockpit-ism: Four insights to enhance the transformative potential of the sustainable development goals. *Sustainability*, 7(2), 1651–1660.
- Hebinck, A., Vervoort, J. M., Hebinck, P., Rutting, L., & Galli, F. (2018). Imagining transformative futures: Participatory foresight for food systems change. *Ecology and Society*, 23(2), 16.



- Jasanoff, S. (2003). (No?) Accounting for expertise. *Science and Public Policy*, 30(3), 157–162.
- Jasanoff, S., & Kim, S. H. (2015). *Dreamscapes of modernity: Sociotechnical imaginaries and the fabrication of power*. Chicago: Chicago University Press.
- Kamijo, Y., Komiya, A., Mifune, N., & Saijo, T. (2017). Negotiating with the future: Incorporating imaginary future generations into negotiations. *Sustainability Science*, 12(3), 409–420. <https://doi.org/10.1007/s11625-016-0419-8>.
- Kok, K., van Vliet Mathijs, M., Bärlund Ilona, L., Dubel, A., & Sendzimir, J. (2011). Combining participative backcasting and exploratory scenario development: Experiences from the SCENES project. *Technological Forecasting and Social Change*, 78(5), 835–851.
- Kuhlmann, S., & Bogumil, J. (2018). Performance measurement and benchmarking as “reflexive institutions” for local governments: Germany, Sweden and England compared. *International Journal of Public Sector Management*, 31(4), 543–562. <https://doi.org/10.1108/IJPSM-01-2017-0004>.
- Lemke, & Van Helden. (2015). Social design literacies: Designing action literacies for fast-changing futures. In J. Rowsell, & K. Pahl (Eds.), *The Routledge handbook of literacy studies*. Routledge.
- Low, S., & Schäfer, S. (2019). Tools of the trade. Practices and politics of researching the future in climate engineering. *Sustainability Science*, 14(4), 953–962. <https://doi.org/10.1007/s11625-019-00692-x>.
- Lukes, S. (1974). *Power: A radical view*. London: Palgrave Macmillan.
- Maier, H. R., Guillaume, J. H., van Delden, H., Riddell, G. A., Haasnoot, M., & Kwakkel, J. H. (2016). An uncertain future, deep uncertainty, scenarios, robustness and adaptation: How do they fit together? *Environmental Modelling & Software*, 81, 154–164.
- Mason-D’Croz, D., Vervoort, J., Palazzo, A., Islam, S., Lord, S., Helfgott, A., ... Lipper, L. (2016). Multi-factor, multi-state, multi-model scenarios: Exploring food and climate futures for Southeast Asia. *Environmental Modelling and Software*, 83(September), 255–270. <https://doi.org/10.1016/j.envsoft.2016.05.008>.
- Miller, R. (2007). Futures literacy: A hybrid strategic scenario method. *Futures*, 39(4), 341–362.
- Miller, R. (2018). Introduction. In R. Miller (Ed.), *Transforming the future: Anticipation in the 21st century* (pp. 1–13). Paris: UNESCO Publishing.
- Morrison, A., Bjørnstad, N., Martinussen, E. S., Johansen, B., Kerspern, B., & Dudani, P. (2020). Lexicons, literacies and design futures. *Temes de Disseny*, (36), 114–149.
- Muiderman, K., Vervoort, J. M., Gupta, A., & Biermann, F. (2020). Identifying four approaches to anticipatory climate governance: Varying conceptions of the future and their implications for the present. *Wiley Interdisciplinary Reviews: Climate Change*, 11(6). <https://doi.org/10.1002/wcc.673>. In press.
- Oomen, J., Hoffman, J., & Hajer, M. A. (2021). Techniques of futuring: On how imagined futures become socially performative. *European Journal of Social Theory*, 1368431020988826.
- Oomen, J. (2021). *Imagining climate engineering: Dreaming of the designer climate*. New York: Routledge.
- Pelzer, P., & Versteeg, W. (2019). Imagination for change: The post-fossil city contest. *Futures*, 108, 12–26. <https://doi.org/10.1016/j.futures.2019.01.005>.
- Popa, F., Guillermin, M., & Dedeurwaerdere, T. (2015). A pragmatist approach to transdisciplinarity in sustainability research: From complex systems theory to reflexive science. *Futures*, 65, 45–56. <https://doi.org/10.1016/j.futures.2014.02.002>.
- Porter, T. M. (1995). *Trust in numbers: The pursuit of objectivity in science and public life*. Princeton: Princeton University Press.
- Rijke, J., Brown, R., Zevenbergen, C., Ashley, R., Farrelly, M., Morison, P., & van Herk, S. (2012). Fit-for-purpose governance: A framework to make adaptive governance operational. *Environmental Science & Policy*, 22, 73–84.
- Rijkens-Klomp, N. (2012). Barriers and levers to future exploration in practice experiences in policy-making. *Futures*, 44(5), 431–439.
- Salmon, R. A., Priestley, R. K., & Goven, J. (2017). The reflexive scientist: An approach to transforming public engagement. *Journal of Environmental Studies and Sciences*, 7(1), 53–68. <https://doi.org/10.1007/s13412-015-0274-4>.
- Shapin, S., & Shaffer, S. (1985). *Leviathan and the air pump: Boyle, Hobbes, and the experimental life*. Princeton: Princeton University Press.
- Snowden, D. (2011). Naturalizing sensemaking. In K. L. Mosier, & U. M. Fischer (Eds.), *Informed by knowledge: Expert performance in complex situations* (pp. 223–235). Hove: Psychology Press.
- Stirling, A. (2008). “Opening up” and “closing down”: Power, participation, and pluralism in the social appraisal of technology. *Science Technology and Human Values*, 33(2), 262–294. <https://doi.org/10.1177/0162243907311265>.
- Stirling, A. (2018). *How deep is incumbency? Introducing a ‘configuring fields’ approach to the distribution and orientation of power in socio-material change (November)*. <https://doi.org/10.2139/ssrn.3289586>. SWPS 2018-23. Available at SSRN: <https://ssrn.com/abstract=3289586>.
- Stoll-Kleemann, S., Riordan, T. O., & Burns, T. R. (2003). Linking the citizen to governance for sustainable climate futures. In B. Kasemir, J. Jäger, C. C. Jaeger, & M. T. Gardner (Eds.), *Public participation in sustainability science: A handbook* (pp. 239–248). Cambridge: Cambridge University Press.
- Swart, R. J., Raskin, P., & Robinson, J. (2004). The problem of the future: Sustainability science and scenario analysis. *Global Environmental Change*, 14(2), 137–146. <https://doi.org/10.1016/j.gloenvcha.2003.10.002>.
- Taylor, C. (2004). *Modern social imaginaries*. London: Duke University Press.
- Tutton, R. (2017). Wicked futures: Meaning, matter and the sociology of the future. *The Sociological Review*, 65(3), 478–492.
- Urry, J. (2016). *What is the future?* Hoboken: John Wiley & Sons.
- Van Lente, H. (2012). Navigating foresight in a sea of expectations: Lessons from the sociology of expectations. *Technology Analysis & Strategic Management*, 24(8), 769–782.
- Van Pelt, S. C., Haasnoot, M., Arts, B., Ludwig, F., Swart, R., & Biesbroek, R. (2015). Communicating climate (change) uncertainties: Simulation games as boundary objects. *Environmental Science & Policy*, 45, 41–52.
- Vervoort, J., & Gupta, A. (2018). Anticipating climate futures in a 1.5 C era: The link between foresight and governance. *Current Opinion in Environmental Sustainability*, 31(January), 104–111. <https://doi.org/10.1016/j.cosust.2018.01.004>.
- Vervoort, J. M., Thornton, P. K., Kristjansson, P., Förch, W., Ericksen, P. J., Kok, K., & Jost, C. (2014). Challenges to scenario-guided adaptive action on food security under climate change. *Global Environmental Change*, 28, 383–394. <https://doi.org/10.1016/j.gloenvcha.2014.03.001>.
- Vervoort, J. M., Bendor, R., Kelliher, A., Strik, O., & Helfgott, A. E. R. (2015). Scenarios and the art of worldmaking. *Futures*, 74, 62–70. <https://doi.org/10.1016/j.futures.2015.08.009>.
- Wack, P. (1985). Scenarios: Shooting the rapids. *Harvard Business Review*, 139–150. November-December.
- Warde, P., & Sorlin, S. (2015). Expertise for the future: The emergence of environmental prediction c. 1920–1970. In J. Andersson, & E. Rindzeviciute (Eds.), *The struggle for the long-term in transnational science and politics* (pp. 38–62). London: Routledge.
- Williams, A., Kennedy, S., Philipp, F., & Whiteman, G. (2017). Systems thinking: A review of sustainability management research. *Journal of Cleaner Production*, 148, 866–881.
- Wolfram, M. (2016). Conceptualizing urban transformative capacity: A framework for research and policy. *Cities*, 51, 121–130. <https://doi.org/10.1016/j.cities.2015.11.011>.
- Wynne, B. (1993). Public uptake of science: A case for institutional reflexivity. *Public Understanding of Science*, 2(4), 321–337.