



Unlocking the potential of gaming for anticipatory governance

Joost Vervoort^{a,b,c,d,*}, Astrid Mangnus^{a,b}, Steven McGreevy^d, Kazuhiko Ota^d, Kyle Thompson^a, Christoph Rupprecht^d, Norie Tamura^d, Carien Moosdorff^a, Max Spiegelberg^d, Mai Kobayashi^d

^a Copernicus Institute of Sustainable Development, Utrecht University, Vening Meinesz building, Princetonlaan 8a, 3584, CB Utrecht, the Netherlands

^b Urban Futures Studio, Utrecht University, Vening Meinesz building, Heidelberglaan 8, 3584, CS Utrecht, the Netherlands

^c Environmental Change Institute, University of Oxford, 3 South Parks Road, OX1 3QY, Oxford, United Kingdom

^d FEAST Project, Research Institute for Humanity and Nature, 457-4 Motoyama, Kamigamo, Kita-ku, Kyoto, 603-8047, Japan

ARTICLE INFO

Keywords:

Games
Anticipatory governance
Futures
Simulation
Foresight

ABSTRACT

Games offer unique possibilities for imagining and experimenting with new systems of governance for more sustainable futures – new rules and institutions, new roles, and new dynamic worlds. However, research on sustainability games has mostly investigated games as a type of futures method, largely divorced from its societal contexts. In this paper, we argue that to unlock the potential of gaming for anticipatory governance in the service of a more sustainable future, it is important to take a whole-society perspective, and examine the possibilities and challenges offered by contextual factors. Using the Netherlands and Japan as examples, we investigate the following questions: 1) How do governance cultures allow or restrict opportunities for the participatory exploration of futures using games? 2) How does, and can, the game sector in a given context support anticipatory gaming? 3) How do dominant societal relationships with games limit, and offer opportunities for, gaming for anticipatory governance?

1. Introduction

The concept of ‘anticipatory governance’ describes processes of governance that aim to actively consider the future to inform present day decisions (Vervoort and Gupta, 2018). There is an urgent need for society-wide engagement with the interacting realities of global climate change and economic and geopolitical upheaval (Steffen, 2015). Current systems of governance are often insufficient to achieve sustainability goals such as those set by the Paris Agreement in 2015 (Van Asselt, 2016) and the Sustainable Development Goals (Biermann et al., 2017); and these goals are themselves critiqued for not being transformative enough (Mair et al., 2018). Many of the technical solutions for avoiding catastrophic global change already exist – the challenge is to imagine and enact the changes in culture and governance that support significantly more sustainable future societies (Biermann et al., 2012). As a result, many sustainability challenges (food, water, biodiversity, energy and more) are characterized by a ‘crisis of the imagination’ (Ghosh, 2018). In the agenda-setting article ‘New Directions In Earth System Governance Research’, Burch et al. (2019) point to this crisis of the

imagination as a core research challenge in anticipatory governance. New approaches that specialize in imagining, experiencing and experimenting with futures have an important role to play in societal transformations.

In this paper, we focus on gaming, which offers a unique avenue for fully engaging with new political and governance futures. ‘Serious’ or ‘applied’ games – games designed with a purpose outside of the play experience - emerged from the same history of foresight tools and approaches as simulation modelling and future scenarios (Mayer, 2009). Games can share many of the characteristics of these approaches – including the simulation of existing and future systems and the exploration of future worlds and trajectories. However, games are unique in that they can allow players to explore new roles, new rules, and new interactions, often in strongly realized worlds, while using a mix of interactive media (Vervoort, 2019).

We argue that there is a need to deeply re-imagine the use of gaming for anticipatory governance in broader societal contexts in order to unlock its potential for better futures. So far, in the world of sustainability futures at least, games have largely been treated as a rather

* Corresponding author. Copernicus Institute of Sustainable Development, Utrecht University, Vening Meinesz building, Princetonlaan 8a, 3584, CB Utrecht, the Netherlands.

E-mail address: j.m.vervoort@uu.nl (J. Vervoort).

<https://doi.org/10.1016/j.esg.2021.100130>

Received 10 November 2020; Received in revised form 6 October 2021; Accepted 12 December 2021

Available online 27 December 2021

2589-8116/© 2021 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

contained category of tools for public participation and participatory futures. We believe that this perspective is too limited - that there are societal and contextual factors that may help understand the present roles, and especially the future potential, of games for anticipatory governance. These factors include 1) how prevailing governance modes and cultures constrain or enable possibilities for game-based participatory futures work; 2) the roles of the game sector in offering possibilities for the development of anticipatory gaming practices; and finally, 3) how societal relationships with gaming restrict and enable anticipatory gaming.

We will start by introducing the link between gaming and anticipatory governance in sustainability contexts as described in the literature. Next, we offer a conceptual framework to help ask: what insights are produced by taking a society-wide perspective on the links between games and anticipatory governance? We will then introduce two contrasting but comparable examples – the Netherlands and Japan. Using these examples, we will investigate and illustrate the questions raised by our conceptual framework. Based on insights from these two cases, we offer insights and recommendations for new lines of research and action toward anticipatory gaming for more sustainable societies.

2. Practicing with futures: games and anticipatory governance

The notion of anticipatory governance has historically been associated with Responsible Research and Innovation and with future technologies (Fuerth, 2009; Gupta, 2004). But recently within the Earth System Governance community (Burch et al., 2019) and elsewhere (Ramos, 2014) attempts are being made to open up this notion to include any governance processes that engage with future uncertainty within the definition of anticipatory governance, and we will follow this more inclusive approach here. This includes those processes that use ‘foresight’ – a collective label for any methods that explicitly acknowledge and structure future uncertainties and ambitions for planning purposes, such as scenario development (Wiebe et al., 2018). But it also includes, for instance, strategies or policies focused on long-term challenges like climate change, strategic vision documents for long-term national development, and long-term community plans, even if these are not explicitly informed by foresight methods (Muiderman et al., 2020). Beyond the explicit planning focus of foresight, we use the wider term ‘futures’ to refer to any practice or method that engages with the future, or multiple futures, more generally. In this definition, all anticipatory governance involves some implicit or explicit futures work.

A key notion emerging from research on anticipatory governance in a sustainability context is that futures are deeply uncertain and governing actors should engage with this uncertainty. Furthermore, futures are increasingly understood as fundamentally *pluralistic* between different societal actors, and should be explored as such (Vervoort et al., 2015). The need to engage with uncertainty, pluralism and transformation prompts anticipatory governance researchers to emphasize practicing and experimenting with futures (Guston, 2014). There is also an urgent need for foresight to play a transformative role if a sustainable future is to be safeguarded, not just for humans but for all life (Rupprecht et al., 2020).

However, globally dominant approaches to imagining more sustainable futures have important limitations when it comes to anticipatory governance (Low and Schäfer, 2019). These limitations are becoming ever more glaring and critical as global crises accelerate (Bai et al., 2016). Much of the globally dominant research focused on future sustainability pathways is dominated by modelling based in environmental sciences and economics. Such approaches excel at global-level analyses of the scale of change that desirable futures entail, and the impacts of futures that should be avoided. But even those involved in such foresight work would readily agree that these globally dominant, assessment-style approaches cannot provide insights into the deep and transformative changes needed to cultures and systems of governance – or to the roles of various societal actors that would be instrumental in

these changes (Klerkx and Begemann, 2020; Pereira et al., 2021; van Sluisveld et al., 2018). Moreover, in many cases, there is still a need to connect between foresight activities on the one hand and policy and governance processes on the other (Vervoort and Gupta, 2018). Finally, there is still a need for foresight approaches to connect better with public imaginations, and to explore the emotional, social, economic and political turmoil that is associated with radical change (Blythe et al., 2018; Pereira et al., 2021).

A stream of research and practice has been responding to this need for more integrative, actionable and collectively imaginative futures work. There has been a turn toward more embodied, imaginative ‘experiential’ futures practices that seek to bring to life diverse futures for the purpose of deeper engagement (Hajer and Versteeg, 2019; Hajer and Pelzer, 2018). Furthermore, ‘experimental’ strains of futures work have sought to prefigure desired futures by enacting them in the present as real practices (Sengers et al., 2019). Experiential and experimental approaches to futures have drawn in the world of art and creative practice as a way to engage with sustainability transformation, such as in the Horizon 2020 project CreaTures (CreaTures, 2021; Dolejšová et al., 2021). There have also been very strong developments in integrating futures work with action in the present from national to local levels – see Ramos et al. (2019) and Vervoort et al. (2014). Ramos (2014) considers approaches and traditions such as anticipatory democracy, futures commissions, and transition management as part of the anticipatory governance domain, and these have strong links to action and governance.

What is notable about such experiential and experimental approaches to anticipatory sustainability governance is that gaming appears quite often as a high potential approach (Bontoux et al., 2016; Vervoort, 2019). Games have great potential to provide answers to these needs to engage, experiment and practice with pluralistic and transformative futures. Serious or applied gaming has a long history in both national and transnational governance, especially in security and intelligence sectors (Smith, 2009). Building on this tradition, the use of gaming for sustainability governance at different levels has also proliferated. Games resist simple definition – prompting Wittgenstein to use ‘games’ as a primary example to problematize the very use of language for categorization (Wittgenstein, 1953, 2009). For our purposes, when we discuss games, we refer to interactive systems (whether digital, analogue or a mix of both) that are composed of player *roles*, of game *rules* - that include limits and incentives that structure player action and interaction - and of *worlds*, functioning as settings or contexts. The combination of roles, rules and worlds forms the core of why games are uniquely valuable for experimenting with futures. The approach developed alongside other methods of engaging with futures such as scenario planning and modelling (Mayer, 2009) and has often been hybridized with these approaches. Gaming can be seen as strongly, but not entirely, overlapping with simulations (Boin et al., 2004) because of the emphasis on play – which includes, in turn, an intrinsic motivation for engagement and the importance of imagination and creativity.

The possibility to take on and engage with roles allows for a forefronting of subjective experience and of personal and group objectives, needs, responsibilities and challenges. Stepping into a game role allows for identification with and immersion in a subjective perspective in a future world (Crowe et al., 2007). It also allows for interactions with other players or characters, whether human or AI-based (Schechtman, 2012). Complementary to this is the focus on rules – which can be used to represent systems of governance, economic systems, biophysical systems and more. These roles and rules are situated in wider worlds, cultures and ecosystems. These worlds are contexts described through writing, artwork, narration, et cetera that invite imaginative engagement. The combination of roles, rules and worlds allows for emergent, interactive explorations of how different societal actors might experience their settings, interact with each other, and respond to or generate new modes of governance. There is increasing evidence that simulation games could help stimulate understanding, empathy and collaborative

action, as well as evidence on the technical understanding of system dynamics and governance processes (Bachen et al., 2012; Rumore et al., 2016; Stover, 2005).

In recent decades, there has been a shift toward the understanding that games should reflect the messiness and interacting subjectivities that characterize governance processes (Mayer, 2009). Examples are games and game-like simulations on land use (Bishop et al., 2009), climate change (Reckien and Eisenack, 2013), energy policy (Dolin and Susskind, 1992), and water governance (Zhou and Mayer, 2017). Such games often have an emphasis on simple game mechanics or open role-playing similar to what one would see in tabletop role-playing games. Such simple game mechanics can support emergent complexity when multiple human players are involved (Guyot and Honiden, 2006).

At the same time, the commercial game sector has developed rapidly in the last twenty years to a level where its global revenues eclipse those of the film industry (Siwek, 2017). 'Serious' gaming and the commercial game development have influenced each other. But there are many aspects to the increasingly diverse and all-pervasive world of commercial games that are as yet disconnected and unexplored in 'gaming for governance' contexts (Vervoort, 2019). Moreover, very little is still known about how the world of commercial gaming impacts public imaginations when it comes to the future. Potential for this impact has been demonstrated in video games' invitation to imagine alternative utopian realities (Aupers 2006). In particular, connecting games to shared imaginaries seems to be an extremely valuable direction of research (Milkoreit, 2017; Moore and Milkoreit, 2020).

Games in sustainability governance contexts have also, to some degree, made use of advances in the game sector (Vervoort, 2019). This has led to a proliferation of different types of games and various possibilities for up-scaled engagement. Massive multiplayer game/scenario hybrid systems have been developed that involved thousands of players (Dunagan, 2012), but there have also been single-player digital games accessible at mass scale (Red Redemption, 2011); there are live role playing games combined with different levels of digital support from models and other systems (Reckien and Eisenack, 2013). Simulation games have been used in different geographical levels (Eisenack and Reckien, 2013)- by local communities, by national governments (Parker et al., 2016), and in high-level global processes by UN organizations and global NGOs (Candy, 2018; Mendler de Suarez et al., 2012). A recent shift in game uses in an anticipatory governance context has been the shift from what Vervoort (2019) characterizes as planning-oriented 'foresight games' to a broader array of 'futures games' more interested in experiential simulations through role-playing, theatre, and VR. Such games emphasize embodied and imaginative engagement as well as collaborative story-telling and meaning-making. However, at the same time, many possibilities currently offered by commercial games are still under-explored in futures games contexts and there is a significant gap between the commercial games sector and the applied or serious games sector.

3. Contextual factors for gaming in anticipatory governance

In this paper, we argue for breaking open the rather limited space of 'games as foresight/futures tools' toward a more systemic and societally embedded approach to gaming for anticipatory governance in sustainability contexts. We will argue for this approach both in terms of its benefits for the development and support of anticipatory gaming for sustainability, and in terms of new directions for research. Key to our investigation is that experiences with games as tools for anticipatory governance differ greatly across different governance contexts – different countries, sectors and domains. What creates these differences, and how can we understand the potential of simulation games in different contexts? We propose that three contextual factors should be investigated.

3.1. Factor 1: Prevailing modes and cultures of governance and participation

As our first contextual factor, we propose that it is important to investigate how governance contexts and cultures enable, constrict and shape the present and potential future use of simulation games for anticipatory governance. This includes the power positions of different actors, institutional constraints and dynamics, the flexibility of goal-setting, and dominant policy instruments. Such aspects have significant consequences for the openness of a system of governance to the use of (participatory) tools for policy experimentation in general, and simulating gaming specifically (Lange et al., 2013). Furthermore, dominant modes of engagement with future uncertainty and dominant ideas of how the future impacts the present may impact the perceived need to experiment with different futures. Are futures engaged with in primarily predictive, adaptive or transformative modes (Muiderman et al., 2020)? This also includes the disciplinary backgrounds common among those involved in governance processes, and connected to this, their levels of previous experience with foresight methods. Finally, Institutional support for reform and the perceived need to move toward a better future will impact the possibilities to use methods to imagine better futures - and these conditions can be very time-dependent (Hebinck et al., 2018).

3.2. Factor 2: game development capacities

Vervoort (2019) details the developments in the global commercial game sector, focusing on the growth of the sector (which has eclipsed many other forms of media). The paper describes radical changes in the support for game development and dissemination; the resulting diversification of game themes and content into more complicated directions; the development of user content in games; new possibilities for immersion and integration with the 'real' world; and the rapid growth of platforms around secondary content creation and storytelling about games. However, when we look at specific national and local contexts, it is often very far from clear how the capacities, skills and resources of the commercial game sector are presently linked to, and could be mobilized for, gaming for anticipatory governance. How does the development of serious/applied games around sustainability governance problems benefit from the presence of an active game sector in a given national context?

3.3. Factor 3: societal relationships to and capacities with games

Another key line of research that this paper aims to open up is how the use of games for the anticipatory governance of sustainability challenges falls within a wider societal context of relationships with and capacities around games, which, in turn, could point to interdependencies between such societal relationships with games in general and possibilities for anticipatory gaming specifically. We want to stress that proposing this direction for research brings up many questions that will be very hard to answer. Gaming has, so far, received little sociological or societal attention as a serious site for social action, as a legitimate part of culture, or as a serious influence on politics. In fact, the very act of looking at games in general society through the eyes of anticipatory gaming research means taking gaming seriously in a way that is entirely uncommon. The lack of the serious engagement with games and social action leaves many empirical problems unaddressed. This starts with a set of questions around societal relationships to games. How can nationally dominant relationships to games be characterized, and how do different attitudes to and experiences with games affect game-based thinking and metaphors? What types of games are different groups of people in this society most familiar with and able to draw upon? To what degree and how are games considered to have a 'serious' side, in the sense that people see skills and ideas associated with games as relevant for other domains of society – as scientific research indicates

they are (see Nisbet and Williams (2009) on cognition and confidence; Sjöblom (2015) on moral reflection; Boot et al. (2011) for a more tentative review on perception and cognition and Granic et al. (2014) for a wide range of effects)? Such questions can also be disentangled further, for instance: what is the prevalence and application of simulation in the society or context in question? What is the role of gamification (the game-like structuring of incentives) in this society or context (Hooghiemstra, 2017)?

Building on such questions, the next line of enquiry is about the interdependencies between societal relationships with games in general and the current roles, and future possibilities, of anticipatory gaming specifically. Such questions are exceedingly hard to study, because they will naturally run the risk of ignoring or excluding many other explanatory variables and relationships. Nevertheless, questions can at least be offered, such as: Do dominant relationships with games change how people engage with anticipatory gaming, for instance, will people be able to draw on certain game-related skills? An even more difficult and nebulous question is: do societally dominant forms of game playing help cultivate certain anticipatory capacities more generally, for instance by extending imaginative capacities (Schinkel, 2005)? We want to at least open this line of thinking.

4. The Netherlands and Japan: two gaming countries grappling with sustainability challenges

The Netherlands and Japan are highly relevant cases for comparison when it comes to environmental and sustainability governance in a broader sense – as well as in terms of the roles of gaming for anticipatory governance. The Dutch context has embraced gaming for anticipatory environmental governance to a far greater extent than Japan; though serious gaming is fairly widespread in Japan as well outside of governance and political settings. There are useful points of similarity and difference on the three contextual factors that we have described:

1. National contexts and environmental governance: The Netherlands and Japan offer similar governance challenges and in both cases, the need for anticipatory governance is high. But the two countries are characterized by very different modes of governance, and these modes of governance are themselves also changing over time. Both countries are highly populated and highly urbanized, and are somewhat comparable in terms of living standards. Importantly, the Netherlands and Japan both have long histories of having to manage natural disasters. In the Netherlands, there has been a long history of having to adapt to flooding in particular (Ritzema and Van Loon-Steensma, 2018). Similarly, in Japan, earthquakes and tsunamis have been a feature of national environmental challenges – as have floods, typhoons, and blizzards (Sato, 2009). The latter problems have been exacerbated by climate change in both countries – with extreme heat being an additional challenge in Japan. As a result, governments have had to take the lead in adaptive governance; but the ways in which this governance is organized are very different. In addition, both countries struggle with transformations toward more sustainable societies.
2. Game development capacities: the Japanese entertainment game sector is a world leading industry; while the Dutch entertainment game sector is healthy but far less dominant. However, the Dutch game sector has a stronger focus on serious games.
3. Societal relationships to games: both countries have strong traditions vis a vis gaming, but there are marked differences in what kinds of games are being engaged with.

We draw our analysis from 1) academic sources; 2) policy and strategy-related documentation and 3) analyses of the game sector. Note that these cases are meant to be explorative examples rather than exhaustive national analyses. In 4.4, we will also discuss any learning and sharing across the two national cases that is happening.

4.1. Gaming for anticipatory governance in the Netherlands

The Netherlands can be characterized as a frontrunner globally when it comes to the use of serious games linked to governance more generally and sustainability governance more specifically. Simulation games have been used in many cases to explore issues around water governance (den Haan et al., 2020), infrastructure and transport (Duffhues et al., 2014), energy (Hettinga et al., 2020), and other sustainability-related governance challenges. In a comparative case study across several European countries, Mayer et al. (2013) characterize the Netherlands as arguably unique because 'Knowledge institutes operating at the interface between science and policy, such as TNO (the Netherlands Organization for Applied Scientific Research) and others like the Defence and Infrastructures like water, energy, urban planning), Deltares (Geo-engineering) have adopted serious games, both in practice as well as in their company strategies. They have their own [serious games] departments and labs; TNO has recently identified serious gaming as one of its strategic flag ships' (pp. 312). So, what about the actual link between such simulation games and governance? Zhou and Mayer (2017) use a q-sort method to interview a number of professionals from both sides of the science-policy interface around water governance. They identify five dominant frames – and each frame is populated by both scientists and policy-related professionals. These frames include 1) bureaucratic alignment – which emphasizes quantitative games to be used to inform and convince publics; 2) stakeholder interaction – which focuses on low-tech games as a way to generate new real-world stakeholder interactions; 3) learning – which emphasizes using games for technical learning without obvious links to real world governance; 4) uncertainty – which treats games as a policy analysis tool akin to scenarios; and 5) a perspective that sees games as a way to bring emotions around water governance into interactions with publics. Of these, perspectives 2 and 4 have the most direct link to actual water governance. Overall, evaluations of the benefits and potential of games for water governance were positive across all perspectives, with some differences. This study is emblematic of the diversity of perspectives that exists in the Netherlands in terms of the different types of application of simulation games for sustainability governance. However, the evidence in the literature for actual impact on governance processes is still very limited. Most research articles reporting on governance games investigate learning processes and new insights and conclusions drawn from game playing (Mayer et al., 2014; Medema et al., 2019; Ouariachi and Elving, 2020); but existing research does not, so far, seem to be as interested in tracking what happens with the game results in actual governance processes afterward. This gap reflects a similar lack of analysis of the link between other multi-stakeholder approaches like future scenarios and governance processes (Vervoort and Gupta, 2018). Finally, it should be noted that while simulation games appear more frequently used and institutionalized in the Netherlands than in many other countries (Mayer et al., 2013), this does not mean that simulation games are a dominant tool for engaging with sustainability governance questions when related to other approaches.

Games that focus on stakeholder interactions typically reflect the rather horizontal, interactive governance context of the Netherlands (see 4.3) – with different groups of stakeholders having different objectives and capacities and incentives for collaboration and conflict drawn from real world conditions (Mayer et al., 2014). Games that focus on future uncertainty often incorporate future (water, climate, land use) scenarios in their game play and feature choices that resemble adaptive management – examples are games focused on adaptive river/delta management as described by van Pelt et al. (2015) and den Haan et al. (2020). Games that emphasize changing biophysical and socio-economic contexts often, but not always, tend to use digital components and quantitative modelling (Erisman et al., 2002); games that focus more on multi-stakeholder issue simulation and resolution can more easily be constructed as analogue-only games. An example of a game environment that combines 1) the complexity of digital simulation

with 2) the richness of human interaction generated through live role playing, and 3) adaptability to specific stakeholder contexts is the Tygron engine. This game environment allows for the construction of complex, case-specific digitally supported live role playing games based on empirical data about biophysical and socio-economic variables (Tygron, 2017). Finally, an entirely different but notable use of game concepts has been the application of different game theoretical heuristics as discussion objects with policy makers (Bekijs et al., 2018).

4.2. Games for anticipatory governance in Japan

In contrast to the Netherlands, the general observation is that simulation games are not, for the most part, explicitly incorporated into the sustainability governance toolbox in Japan so far. But as a country with a long history of gaming, a world leader in commercial gaming and game development, simulations and games do appear to be influential in many societal contexts where questions of governance are either directly or indirectly at play. Games have been prominent in one governance context – that of the military. Notable is the Total War Research Institute in 1940 (Ichikawa, 2014) and its multidimensional governance game effort called ENREN. The Giseikai research institute for economic-business gaming was founded in 1943 to pursue holistic gaming simulations for the Japanese national economy, modelled explicitly on ENREN (Ichikawa, 2014). In the 1960s and 1970s, war-gaming and techniques for total war mobilization were adapted into sociological, economic, and business simulation methods for peacetime use. However, Japan does not currently appear to have any major dedicated governmental funding sources to engage with serious gaming for governance. One of the few examples is the “CIGS Policy Simulation” game, hosted by the Canon Institute for Global Studies (CIGS) (Canon Institute for Global Studies, F.A.a.N.S.G., 2017). However, in a larger sense, CIGS’s activities are quite rare for Japan and even the existence of these games seems to depend on the support from the US Department of Defense and Defense University (ibid.). At the local level, there is a highly notable case: Nakagawa et al. (2017) conducted local-level experiments in live governance contexts, based on previous lab experimentation, where they used role playing games with local government officers to introduce the interests of future generations into local governance processes. This use of role playing the interests of future generations was very well received by the involved local government actors – and even resulted in a degree of institutionalization of the approach into a ‘department of the future’. There is also interest in scaling out this approach to other local governments. Academics working at the intersection of political science and simulation & gaming have also explored politics and governance through games. In the “Forming a Coalition Government” game, developed at Tokai University, players play powerful real-world political leaders and interact in a virtual political world, while two facilitators (a time-keeping “speaker” and the “mass media” who aids discussions) help players unite or dissolve political alliances (Kuboya and Kimura, 2005).

One area where Japan has an abundance of experience, and one that is particularly relevant for anticipatory environmental governance, is in simulations for disaster planning, ranging from fully fledged experiential simulations of how to act under disaster conditions and staged drills used in disaster response education. A unique and remarkable feature of Japan is the annual, nationwide disaster preparedness training and drilling that occurs every September. The systematic incorporation of different levels of government, from the national to the neighborhood, as well as various public and private agencies and organizations is seen as a world-leading model for other countries to follow (Bank, 2016). To mark “Disaster Preparedness Day” (September 1st), educational events, neighborhood drills, and agency-wide trainings are held. At the national level, a major simulation drill takes place every other year in which the national government and nine cities and prefectures around the Kanto area presume a massive earthquake has occurred in Tokyo (ibid.). The simulation includes tabletop drills involving “220 people in charge of

disaster response from relevant ministries” (ibid., pg. 23). At the neighborhood level, citizen councils organize mock disaster response exercises and evaluate the amount of time it takes for residents to arrive at evacuation zones. Discrete courses and trainings geared for specific disaster management professionals is also being developed, mainly by academics in Japan. The SASKE-NABLE simulation game uses a workshop-style setting to teach city officials and disaster managers how to deal with the unexpected problems that arise in evacuation centers post-natural disaster (Otsuki et al., 2016). Role-playing simulation decision theaters have also been developed by academic teams as educational tools used in disaster response preparedness. The VEQRES/SATAI Virtual Earthquake RESponse simulation game blends live role-playing and a computer model to train emergency response coordinators (Kaji et al., 2005).

4.3. Contextual factor 1: Governance contexts and spaces for participation

In the Netherlands, the institutionalization and use of simulation games for sustainability governance can be related to the broader institutionalization of public participation – though public resources have dwindled through increasingly neoliberal policies. Nevertheless the dominant mode sustainability governance in the Netherlands can be broadly described as ‘interactive governance’ (Lange et al., 2013) – with an emphasis on horizontal engagement with public and private sectors and stakeholders, and an emphasis on negotiation and compromise. In terms of the governance of the natural environment, the dominant role of water in the Netherlands in terms of flood risks, agriculture and other aspects (Van Der Brugge et al., 2005) has arguably contributed to this interactive mode of governance – because water governance intersects heavily with the governance of other areas such as food, energy, transport and urban development. In recent decades, specifically, the Netherlands has shifted to more adaptive water governance approaches which have furthered the need to integrate uncertainty and associated adaptive capacities into governance (Pahl-Wostl et al., 2013; Wiering and Arts, 2006). However, beyond this broad characterization, different perspectives on the governance of sustainability challenges exist. Zhou and Mayer (2017) demonstrate that different perspectives on required modes of governance (top-down; interactive stakeholder collaboration; governance focused on technical problems etc.) have a direct relationship with how both scientists and policy-related stakeholders view the value of games.

In terms of anticipatory governance, the Netherlands has significant experience with futures and scenario planning in many sustainability contexts. More recent examples in the Dutch government are the scenario work conducted by the Dutch Council for Government Policy (WRR) (van Asselt et al., 2010) and the integration of scenario planning in activities by the Ministry of Social Affairs and Employment (Bosch et al., 2019) and the Ministry of Agriculture, Nature and Food Quality (Lesschen et al., 2020). The Dutch Planning Bureau for the Environment is a leader on scenario planning nationally and globally, including in Integrated Assessment Modelling that supports international environmental assessments like those of the IPCC (). In the private sector the proliferation of scenario planning in the private sector includes the influential example of Royal Dutch Shell (Wilkinson and Kupers, 2014). Normative visioning exercises are also conducted regularly from local to national levels and across different sectors by leading organizations such as the Dutch Research Institute for Transitions (Loorbach et al., 2017) though visioning is still in the minority in gaming contexts compared to more adaptive approaches.

By contrast, the dominant mode of governance in Japan can be described as top-down governance with elements of public-private governance (Lange et al., 2013; Mulgan, 2005; Stockwin, 2005). The Liberal-Democratic Party (LDP) has been in power almost continuously since 1955, while other parties have struggled to exert influence and most political divisions happen within branches of the LDP itself (Krauss

and Pekkanen, 2010) At the same time, citizens have historically had low trust in the central government (Aldrich, 2012). Nevertheless, many Japanese look to the government to take responsibility for governance problems, and to move toward participatory governance for local issues (authors removed). In terms of civil society, scholars have argued that active citizens are expected to be “apolitical and to collaborate with authority” (Ogawa, 2009). In terms of anticipatory governance, the Japanese government has focused strongly on predictions in terms of longer-term perspectives, creating discussions around the limits of prediction, for instance as related to earthquakes (Geller, 2017) and fertility rates (Nishimura, 2012).

Civil society organizations mostly operate at the community or local level, meaning there is no strong civil society sector influencing government activities and political discourse (Yamakoshi, 2020). Government collaboration with major private sector actors, however, is more common. The strong links between government, bureaucracy and industry have been termed an ‘iron triangle’ (Stockwin, 2005) and today, public and private sectors remain heavily entangled (Mulgan, 2005). This has contributed to declining voting rates, particularly among the younger generations, reflecting an expanding disinterest in public engagement and apathy towards governance processes in general (Ministry of Internal Affairs and Communication, 2016).

This governance background may leave little space for participatory planning. However, changes are being made to the current top-down, public-private governance system – specifically in the form of decentralization of power to local governments. Such local governments are searching for ways to increase their capacities for local policy development (Mayama, 2018). This shift is indicative of a counter-current of Japanese environmental governance that arose out of the pollution crises of the 1960s, most notably the air pollution and Minamata disease crises. These crises forced a reevaluation of the top-down governance approach to account for the experiences and suffering of the victims of pollution, which top-down approaches could not respond to, no matter how technically proficient they were (Sato, 2009). This point of view has become typical of Japanese environmental sociology, and has been complemented since the turn of the century by management approaches that focus on desirable futures, not simply past events that must be addressed (Matsuhita, 2007; Wakita, 2015). Despite the significance of these counter-currents, a top-down and crisis management logic remains predominant. For example, climate change is not often discussed by the government and media in relation to extreme events affecting Japan such as the typhoons, erratic rains, and extreme temperatures of 2018, restricting the public capacity for sustainability deliberation (Eckstein et al., 2019). Similarly, national visions captured in government documents exist (Cabinet of Japan, 2015; Ministry of Agriculture Forestry and Fisheries, 2010; Ministry of the Environment et al., 2018), but they are not commonly developed in a participatory manner. A counter-example is that of the Social Implementation Program on Climate Change Adaptation Technology (SI-CAT) which included stakeholder workshops with local level government officers of various departments, business associations, researchers, and citizen organizations (Hosei University, 2018).

Connecting these reflections on modes of back to gaming - we can conclude that the Netherlands is characterized by a mode of participatory governance that has provided a relatively fertile ground for anticipatory gaming; while in Japan, possibilities for anticipatory gaming are currently opening up because of an increased focus on local governance – and in the development of local and participatory visions.

4.4. Contextual factor 2: Simulation games, the game sector, and game development capacities

Regarding the Netherlands, Mayer et al. (2013) find that the policy-driven investment into serious games in the Netherlands has been much more significant than in other countries over the time period they analyzed (2004–2013) – 100 million Euros in the Netherlands compared

to, for instance, 5–10 million Euros in the United Kingdom. The argument for providing funding for serious games is related to several policy discourses: 21st century learning; the boosting of creative industries and innovation; social cohesion and empowerment; and complex systems issues. One of the Dutch government’s sub-categories for funding ‘top sectors’ more broadly is ‘games’, which covers both commercial and serious games funding. Partly as a result of such investment, both the Dutch game sector in general and the serious/applied game sector are relatively prolific. According to a report by the Dutch Game Garden (an Utrecht-based hub for 30 startup game companies) in 2016 (Dutch Game Garden, 2018), there were 160 game studios focusing on entertainment games; 119 game studios focused on applied/serious games, and 36 game studios focused on both entertainment and applied/serious games. In the Dutch Game Garden’s reporting, healthcare and education are the most common themes of applied games, although the output is highly diverse and demand-driven. Policy making is not a major theme within the local game output, although games on government could fall into the “awareness” or “planning” categories. There are 44 full-time game-related professional education programs that together deliver 1600 graduates each year. A number of these programs engage with both commercial game development and serious/applied game development – for instance, at the Utrecht-based University of the Arts (HKU), students who are otherwise trained in commercial game developments get mandatory serious game design courses focused on health and sustainability. Such educational institutes are also key partners in serious and applied game projects organized by the national government – including a collaboration between the Netherlands and Japan on the future of serious/applied games design (Dutch Games Association, 2019; Furuichi, 2017). A number of serious game companies have emerged from institutes like the HKU. We conclude that in the Netherlands, the development of the commercial game sector and nationally available capacities for applied game development are strongly connected in terms of funding, practice, and education. However, more recent years have raised critical voices about government support for the game sector and its support of the cultural value of games, which has increased in neighboring countries like Germany (Maessen, 2019).

The Japanese game sector stands out as one of the world’s most dominant game sectors (Global Industry Analysts, 2020). In terms of its history with digital games, the Japanese game sector has, since the 1970s, focused strongly on console and (at a smaller scale) arcade development (Koyama, 2016). Because of the popularity of and success of the console market, PC gaming has never gained a significant foothold in Japan. This has meant that there has been less of a focus on PC-style simulation games in the Japanese game sector, and more on other genres. Consoles do not typically have the calculation power for complex simulations, and are more focused on providing powerful visual output. However, the Japanese game sector has produced a number of games that have important simulation-related characteristics. In contrast to the relative absence of simulation games focused on anticipatory governance, there is actually an active broader field of serious game development in Japan, both in terms of game studios (Nintendo, 2005) and in terms of games researchers (Fujimoto, 2007; Kishimoto et al., 2017; Kurahara and Ono, 2016; Sekiguchi et al., 2016) Private foundations such as FOST (Foundation for the fusion of science and technology) also provide funding sources for serious game development since early 2000s. The focus in serious game development and studies is mostly on educational games. The Gaming and Simulation Scholarly Association focuses mostly on education and e-learning. This organization focuses on how to explain, represent and research active learning through simulation games. The focus on simulation gaming is heavily influenced by the work and networks of Toru Fojimori, a serious games pioneer in Japan, who focuses mostly on pedagogy and education at Tokyo University and beyond (as documented by Fujimoto, 2007); other key authors are Yoshida (2017) and Nakamura (2018). Notable is, again, the collaboration between Japanese and Dutch educators, game developers and governments to create opportunities for learning around

serious gaming (Furuichi, 2017). Notable is that many consulting firms incorporate gamification methods to improve productivity (NI Consulting, 2020). Serious games that come closest to games for anticipatory governance are often simulation-style management games (Kurozawa, 2019). Game companies that have most experience with simulation games, such as Koei Tecmo, have also been involved in the development of such serious management simulation games (Koei, 1990). Specific management games of relevance to sustainability concerns include the development of a farming simulation game for Rakuten integrated with a real-world community agriculture platform (McGreevy & Rupprecht 2018).

Connecting these reflections on the Dutch and Japanese game sectors back to gaming for anticipatory governance, we can conclude that the Dutch game sector, while relatively modest in size, offers some useful examples of gaming for policy and connections between commercial and serious game development, including in education – while in Japan, serious game development has focused less on the political and more on education and training, and links between commercial and serious gaming are more specific.

4.5. Contextual factor 3: Societal relationships with gaming

For the Netherlands, understanding cultural relationships with games is not an easy task. Research by the Dutch Social Cultural Planning Bureau does not even recognize games separately from other digital media (van den Broek and Gieles, 2018). This points to a need for large-scale sociological research into Dutch relationships with games. However, significant pieces of the puzzle can still be found. In the Netherlands, multi-player board games have long been a widespread pastime (Buijnsters and Buijnsters-Smets, 2005). Notable is the influence and popularity of ‘euro games’ or ‘designer games’ such as Catan – mostly of German origin since the 70s – defined as games with a focus on simulating economics and resource management systems, player interactions through those resource management systems, and an emphasis on strategy and a downplaying of luck. A number of such strategic games have a thematic connection to Dutch colonial history (van Zoest, 2019). The Netherlands has historically been among top countries globally in terms of access to personal computers, and later, the internet (Centraal Bureau voor de Statistiek (CBS), 2018; Eurostat, 2020). The high presence of personal computers has meant that simulation games (resource management games, strategy games and other simulations of complex systems) have been more widespread than would be possible if console video game systems were the dominant platform for game play – because PCs allow for the computing power necessary for complex simulation games and PC gaming is less associated with games as ‘toys’ (Veraart, 2011). This means that there is a higher chance (compared to, for instance, Japan) that professionals involved in governance as well as those involved in game design in the Netherlands have a frame of reference in digital simulation games. However, the percentage of people with some experience with digital simulation games may still be rather low – Eurostat data show that in The Netherlands, 47% of recent internet users played or downloaded games at all (Eurostat, 2019), and we can safely assume that not all of those gamers play simulations. Whether such experience is higher than average among those involved in or interested in sustainability governance or broader sustainability politics is another open question. Our own admittedly anecdotal experience involving both game designers and policy experts in game design, mainly in game jams focused on sustainability, is that digital simulation games and resource-focused board games often serve as a frame of reference when these groups are asked to design games around sustainability governance in the Dutch context.

In the Japanese context, games are a dominant cultural presence. Tabletop gaming has a long history in Japan and while games like Mahjong are seeing widespread play in recent years, including a professional team-play league, no two games have more cultural

significance than Go and Shogi (Silver et al., 2017). Digital games are iconic for Japan – exemplified by former Japanese prime minister Shinzo Abe dressing up as game character Mario to announce the hosting of the 2020 Olympics in Japan (Rich, 2016). Large game arcades, though dwindling in numbers, are still to be found everywhere, especially in comparison to almost anywhere else in the world (Lewis, 2017). Massive Pachinko pinball halls can be found all across the country as well (Urranaka and Ando, 2018). However, the link between this large cultural presence of games and simulation gaming is more tenuous. In terms of digital games, the runaway success of Japanese consoles (Nintendo, Sega and later Playstation) has limited the PC gaming market as mentioned (Picard, 2013); in addition, it has also contributed to the relatively limited presence of tabletop roleplaying games in Japan – which arrived from abroad just as the Famicom system took over the gaming market (Kondo, 2019), although console-based role playing games made tabletop roleplaying games more well known in turn as well (Kinnersly, 2019). In 2018, Japanese game companies mostly focus on consoles; independent game developers focus on mobile games. Independent game developers focusing on smaller games for PC or console are still making fledgling efforts, as the funding, distribution platforms, and awareness necessary for viability are only beginning to become available (Garst, 2018). At the most recent Bitsummit, an annual event which gathers together the most important indie developers in Japan, many of the Japanese non-smartphone developers were hobbyists, students, or foreign residents of Japan from Europe or North America (Bitsummit, 2019). The absence of PC and tabletop roleplaying games has limited the possibilities for Japanese publics to become familiar with certain types of simulation-style games. Before the rise of console gaming, war gaming was associated with militarism, not only in a government context but also as a hobby, which gave this style of gaming a negative connotation after World War 2 (Tamura, 2016). Games on the Japanese market are often characterized by linear progression through pre-defined objectives; or entirely open-ended play – there is less of a focus on reacting or adapting to uncertainty in most games, with the exception of “dungeon crawlers” and related genres such as ‘roguelikes’ where death is permanent and restarts the game (e.g. *Shiren the Wanderer* (Chunsoft, 1995)) and survival horror games. Instead, importantly, Japanese simulation games have tended to focus on community and interpersonal relationships in the “life simulation” genre, including a vast array of dating simulators, but also *ikusei* simulators focused on rearing and education, and community oriented games like *Harvest Moon* (Amccus, 1996), *Rune Factory* (Neverland co. ltd., 2006), and the internationally successful *Animal Crossing* (EAD, 2001; Navarro-Remesal and Loriguillo López, 2015). Finally, modern board game cafes have become more prolific in Japan in recent times – these public gaming spaces focus mostly on playing translated versions of the system-focused ‘euro games’ mentioned in the Dutch context (Baggett, 2020).

In short, the Dutch context offers potential for cultures of anticipatory gaming because of its history of simulation gaming; while the Japanese context has a uniquely prominent societal role for gaming, with a focus on other types of games – that could nonetheless form a basis for anticipatory gaming that goes beyond large-scale simulations of sustainability challenges.

4.6. Learning across national cases: examples

Our two examples indicate the strong potential of working and learning across national cases. In fact, cross-national learning has been happening. There have been efforts to connect serious gaming insights between the Netherlands and Japan supported by the Dutch embassy (Furuichi, 2017). In addition, the authors have recently led a process in Japan that draws on lessons from game prototyping in both Japan and the Netherlands. In the ‘Serious Board Game Jam’, a protocol for creative game prototyping was used on several occasions to build sustainability-focused games with an emphasis on the politics and

governance of food systems (Ota, 2018). The game jam process involved experts on food systems and on game design, as well as game design students, leading to a wide diversity of games that aim to be explicit explorations of food politics. The game jam protocol is itself game-like – it is a competition that scores games on various aspects to encourage political and systems-based game play in the prototypes. The goal of this game jam format is to establish a new mode of game development in the Japanese context. It was inspired by, and in turn inspires, several similar game jam processes around sustainable futures in the Netherlands (Transmango, 2018).

The development of specific games can also be opportunities for cross-context learning. As an example, a game is being developed in the Netherlands that directly links Dutch governance contexts with Japanese game design (Vervoort, 2021a). This game will allow players to participate in lawsuits against powerful actors such as governments and fossil fuel companies to force them to divest from fossil fuel investments. The game is directly inspired by the classic Japanese Ace Attorney game series - courthouse games where the player plays an idealistic lawyer in intense court cases (Capcom Production Studio 4, 2001). The game has many features common to Japanese games: manga/anime-style larger-than-life, stylized, engaging and humorous storytelling, turn-based court battles, and elements of slice-of-life simulation. In the climate courthouse game, these typically Japanese game traits will be used to create an interesting juxtaposition with the game's content – very real Dutch climate lawsuits that players can play through to learn about how they might be involved in mobilizing legal action against powerful actors. What is more, the game's crowdfunding process will be used to raise funds for a real climate lawsuit. Civil servants are planning to take the Dutch civil servant pension fund ABP to court over its investments in fossil fuels. The climate courthouse game's concept – remixing a classic, well-known, humorous Japanese game with real climate court battles – is used consciously as an attractor for fundraising.

5. Leverage points for unlocking the potential of anticipatory gaming

Here, we use the insights from our two case studies to shape an agenda for research and action on society-wide approaches to anticipatory gaming for sustainable futures.

5.1. The systemic integration of gaming and anticipatory governance

Examining the use of gaming for anticipatory governance in the Netherlands and Japan in their broader governance contexts, we conclude that there is great scope for a more purposeful and systemic integration of gaming and anticipatory governance. We would like to propose the following points:

1. *Consider how gaming actually impacts governance:* In the Netherlands, anticipatory gaming is already relatively established in sustainability governance contexts. The key leverage point is the need for much better consideration of how gaming actually impacts governance – the development of policies and strategies, changes to public participation, the formation of new networks and initiatives, and more. In this way, anticipatory gaming faces challenges similar to what researchers are now attempting to tackle with other foresight and futures approaches (Hebinck et al., 2018; Vervoort and Gupta, 2018). This is a question for design as well as for evaluation, as these two go hand in hand. The same recommendation goes for Japan, where simulation gaming in governance contexts is relatively less established, but where there is a real opportunity to focus on the local level, and on impact-oriented design from the start. This requires a different mindset to anticipatory gaming – seeing such processes not simply as educational or exploratory, but designing gaming into the heart of anticipatory governance processes, and recognizing the possibilities to come to real, actionable outcomes (Magnus et al., 2021).
2. *Consider the politics of anticipatory gaming:* There is a need for greater reflexivity on the politics of the use of gaming in governance contexts. In the Netherlands, as we have seen, there is a wide diversity in terms of how serious game developers bring in the politics of sustainability challenges (Zhou and Mayer, 2017). Anticipatory games can be designed for explicit and deliberative investigation of sustainability politics and power dynamics – but they are also often framed in a much more technical manner, or as tools to convince players about the need for certain policy actions. In Japan, those games that come closest to anticipatory engagement with sustainability challenges tend to be depoliticized, focusing on management or on crisis response. Can the political goals of anticipatory gaming be made more explicit? Related to this, there are questions of agency to be asked. Who designs and leads anticipatory games and the processes in which they are embedded? Who are the target players? Which actors and groups are involved or left out, and what are the implicit assumptions and power dynamics in such decisions?
3. *Anticipatory gaming for public political agency and deliberative sustainability governance:* There is much to explore in terms of the use of games as a mechanism for fostering political agency and for inclusive deliberative engagement. In Japan, municipalities are now in a position where they are asked to explore and develop local policies more autonomously. Because of this, local municipalities are looking for methods to develop their participatory planning capacities. Work on using role playing for the integration of future generations into governance in Japan by Nakagawa et al. (2017) and Kamijo et al. (2017) indicates that there is receptivity for innovative approaches to local governance among municipalities. The future generations role playing approach is not yet common in the Netherlands, where it would be equally valuable. Simulation games could help publics and civil society actors practice and experiment with political agency: a sense of trepidation around political engagement in Japan could also be addressed by simulation gaming. And though public engagement is much more common in the Netherlands, there is also a growing sense of political disempowerment and training in political agency would be valuable in that context as well (Sociaal en Cultureel Planbureau (SCP), 2019) (58-9). In fact, normalizing anticipatory gaming in educational settings would help pave the way for integrating anticipatory gaming more closely in governance settings, making it less of an exceptional, boxed in activity that takes people out of their normal way of working, which it still remains even in the Netherlands. We propose that much can be learned, in particular, from bringing research and practice together between anticipatory gaming and deliberative democracy practices such as mini-publics (Dryzek, 2009).
4. *Consider the space for transformative ambitions:* How transformative are the ambitions of an anticipatory gaming process? Is there a theory of change that is likely to lead to significant shifts toward more sustainable futures? The stories told by both the Dutch and Japanese cases are of an interest in gaming and simulation for the purposes of adaptation – adaptive governance (the Netherlands) or crisis preparation (Japan). In the model of anticipatory governance offered by (authors removed), this means that the focus is on prediction or navigating complexity - both countries struggle to engage with transformative ambitions and the mobilization of publics when it comes to sustainability. What does transformative gaming look like? We believe the next sections help answer this – and we believe the example of the climate courthouse game in section 4.6 offers and example.

5.2. Mobilizing the game sector: breaking down the walls between serious and commercial gaming

As we have seen in both the Netherlands and Japan, there are many

possibilities for harnessing the capacities of game industries for anticipatory gaming. Our core recommendation for further research and action in this regard is for commercial game industry actors, serious game developers, and actors involved in sustainability governance to explore design spaces situated between commercial games and serious anticipatory games. We break this down as follows:

1. *Understanding possibilities for engagement offered by commercial anticipatory gaming.* In the Netherlands, games with heavy simulation elements have already been commercial successful for a long time. In Japan, the same can be said for management and slice-of-life games that can be said to focus on simulation on a smaller scale. Such simulation elements are present in entertainment games purely because they are engaging. If we relax the ‘serious game’ framing and look at our societal challenges through the commercial game sector’s lens of engagement, what might be seen? How could the themes and mechanisms of anticipation, global transformations and the need for radical change be used in games for the sake of engagement, simply because they offer interesting play, storytelling and world-building possibilities (Vervoort, 2021b)? A general point would be that politics and power make for more engaging game play (Thompson, 2021). In what ways could commercial anticipatory gaming be a valuable direction for game development?
2. *Supporting hybrid anticipatory game sectors.* In the Netherlands there is already a rather uniquely active entanglement between the commercial game sector and serious games development as mentioned. Serious game design projects are often used by smaller developers to provide steady income, allowing for the less financially predictable work on commercial games. This model could be understood better, and consciously supported and funded when recognized as a key source of anticipatory capacities. The same direction can be proposed in the Japanese context, but more work is needed to develop the link between the very prolific Japanese game sector and the development of applied/serious games more generally and a potential market for anticipatory games specifically. Hybrid funding mechanisms will be especially important – and here is a role for public and private sector game funders. There are already examples of games, such as Eco (Strange Loop Games, 2018), that were originally developed as serious games, and then later extended to commercial markets. How can such hybrid development be supported further? Of particular interest could be the support of games on platforms such as mobile phones that have benefits in terms of accessibility – and in terms of integration with everyday life through approaches like augmented reality and location-based gaming in real spaces (Lange, 2011). Finally, the increasing integration of gaming platforms, with games being able to appear on PCs, consoles, and mobile devices, will aid the integration and blending of different types of games, also internationally.
3. *Connecting game-related research disciplines.* More integration in research and education across game-related disciplines – game studies, game design, the social science of games in society, and computer science – beyond its current focus on education and training and toward games that incorporate governance objectives and concerns would support the potential for mobilizing game sectors for anticipatory governance. They also require close collaboration with the game sector and with governments and other governing actors, as well as with publics.

5.3. Growing a culture of anticipatory gaming

Drawing on what we have learned from our two cases, we want to call for an active re-imagining of the (perceived) role of anticipatory gaming as a key aspect of more sustainable societies. The most utopian version of this potential might be imagined as societies where there are many bridges between play and anticipation, suffused at all levels with opportunities for playful engagement with complexity and the

exploration of new futures. An important first step toward this culture of anticipatory gaming is, we believe, active work to break down the walls between entertainment/commercial and serious gaming and the roles they play in society. But this raises many questions:

1. *Understanding the effects of games on anticipatory capacities.* What do we mean when we consider the link between gaming and anticipatory capacities? Capacities that could be investigated could include systems thinking, generative futures literacy, critical futures literacy, actionable futures literacy, political literacy, adaptive planning, perspective taking and empathy, and stepping out of current frames of governance (Mangnus et al., 2021). If so, what capacities should be focused on under what conditions? When it comes to entertainment games in cultural contexts, a great deal of fundamental research is still missing – and many of the questions raised in section 3 require empirical research. This research can be supported by work on the sociology of performance (Goffman, 1956) and rituals (Collins and STU - Student, 2004), see for instance (Moosdorff, 2021). Research already exists that connects gaming to a wide range of capacities (Granic et al., 2014) including the understanding of complex problems (Squire, 2005; Wu and Lee, 2015) – and such research could be tied more explicitly to anticipatory capacities and futures literacy, both among general publics and, importantly, among professionals working in anticipation-focused settings (planners, policy makers, etc.). We would like to highlight the importance of investigating hybrid education: how could commercial games be used in formal education? How can commercial games be understood as sites for informal education? Questions around inclusivity and material access to games would be important here as well.
2. *Understanding the potential of gaming communities, platforms and cultures.* There is another level to consider: current gaming landscapes do not simply feature games and players – they are ecosystems of social media including streamers with tens of millions of viewers and the on-line cultures consisting of hundreds of millions of players interacting with each other outside these games. Game platforms and cultural spaces have already formed the basis for political action and for the dissemination of different ideologies in the Netherlands and Japan and elsewhere, even if these are not always (to put it lightly) prosocial or sustainability-minded (O’Donnell, 2020). How can the politics of such massive gaming cultures be understood as relevant to anticipatory governance? Of particular interest to us is the question of how gaming communities and cultures contribute to the development of different future imaginaries that are relevant to sustainability concerns (Milkoreit, 2017). Furthermore, we would like to argue that the notion of the mobilization of pop culture by actors seeking to promote different ideologies, as operationalized by Milkoreit (2019) for other media, could be an especially valuable direction of research for games – since mobilization can happen not only *around* game spaces but also *in and through* game spaces (Noijons, 2021) – and even through game development and fundraising, as shown in the climate courthouse game in section 4.6.
3. As a concrete example for the above calls to action, the climate courthouse game and its development process described in section 4.6 engages with many of the recommendations – including a conscious focus on politics and power in sustainability governance, new avenues for public engagement, a hybrid approach that combines serious and entertainment game elements, and using the game development process itself for cross-sector engagement. The game development also involves a wide range of serious and commercial game developers, lawyers, governance scholars, activists. The game’s re-mixing of Japanese game development styles with a (still new) feature of Dutch climate governance also offers one of many such re-mixing and learning possibilities across national contexts.

6. Conclusions

In this paper, we have argued for an opening up of gaming for anticipatory governance in sustainability contexts – beyond the current, rather narrow and fragmented applications of ‘serious’ anticipatory games and toward society-wide, systemic engagements with anticipatory gaming. We propose that contextual factors – modes of governance, national game sectors, and national gaming cultures – should be investigated and engaged with to unlock the potential of hybrid, anticipatory gaming for sustainable futures. We drew on two national cases, the Netherlands and Japan, to arrive at a set of insights and recommendations for society-wide engagements with anticipatory gaming. Our hope is that these recommendations open up new lines of research as well as new lines of collaborative action by game developers, funders, governments and researchers. Finally, we would like to argue for more learning across different national contexts – including comparative case analyses but also in the form of learning through shared anticipatory game development projects.

CRediT authorship contribution statement

Joost Vervoort: Conceptualization, Methodology, Writing – original draft. **Astrid Mangnus:** Conceptualization, Methodology, Writing – original draft. **Steven McGreevy:** Conceptualization, Methodology, Writing – original draft. **Kazuhiko Ota:** Conceptualization, Methodology, Writing – original draft. **Kyle Thompson:** Conceptualization, Methodology, Writing – original draft. **Christoph Rupprecht:** Conceptualization, Methodology, Writing – original draft. **Norie Tamura:** Conceptualization, Methodology, writing (revision). **Carien Moosdorff:** Conceptualization, Methodology, writing (revision). **Max Spiegelberg:** Conceptualization, Methodology, writing (revision). **Mai Kobayashi:** Conceptualization, Methodology, writing (revision).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This article is supported by the Dutch Research Organization (NOW) who funded the NWO Vidi project ANTICIPLAY (project number VI.Vidi.195.007). This work was implemented as part of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFA), which is carried out with support from CGIAR Fund Donors and through bilateral agreements. For details please visit <https://ccafs.cgiar.org/donors>. Moreover, we would like to thank the BNP Paribas Foundation for its support of the RE-IMAGINE project. We would like to thank the Research Institute for Humanity and Nature - FEAST project (grant no: 14200116) for supporting this research. The article was also supported by the CreaTures project. This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 870759. The content presented in this document represents the views of the authors, and the European Commission has no liability in respect of the content.

References

Aldrich, D.P., 2012. Black Wave: How Networks and Governance Shaped Japan’s 3/11 Disasters. The University of Chicago Press, Chicago, IL.
 Amecus, 1996. Harvest Moon. Pack-In-Video.
 Bachen, C.M., Hernández-Ramos, P.F., Raphael, C., 2012. Simulating REAL LIVES: promoting global empathy and interest in learning through simulation games. *Simulat. Gaming* 43, 437–460.
 Baggett, A., 2020. Tabletop Gaming in Kyoto. Tokyo Cheapo.
 Bai, X., van der Leeuw, S., O’Brien, K., Berkhout, F., Biermann, F., Brondizio, E.S., Cudennec, C., Dearing, J., Duraiappah, A., Glaser, M., Revkin, A., Steffen, W.,

Syvitski, J., 2016. Plausible and desirable futures in the Anthropocene: a new research agenda. *Global Environ. Change* 39, 351–362.
 Bank, W., 2016. Learning from Disaster Simulation Drills in Japan.
 Bekius, F., Meijer, S., de Bruijn, H., 2018. Collaboration patterns in the Dutch railway sector: using game concepts to compare different outcomes in a unique development case. *Res. Transport. Econ.* 69, 360–368.
 Biermann, F., Abbott, K., Andresen, S., Bäckstrand, K., Bernstein, S., Betsill, M.M., Bulkeley, H., Cashore, B., Clapp, J., Folke, C., Gupta, A., Gupta, J., Haas, P.M., Jordan, A., Kanie, N., Kluvánková-Oravská, T., Lebel, L., Liverman, D., Meadowcroft, J., Mitchell, R.B., Newell, P., Oberthür, S., Olsson, L., Pattberg, P., Sánchez-Rodríguez, R., Schroeder, H., Underdal, A., Camargo Vieira, S., Vogel, C., Young, O.R., Brock, A., Zondervan, R., 2012. Navigating the anthropocene: improving earth system governance. *Science* 335, 1306–1307.
 Biermann, F., Kanie, N., Kim, R.E., 2017. Global governance by goal-setting: the novel approach of the UN Sustainable Development Goals. *Curr. Opin. Environ. Sustain.* 26–27, 26–31.
 Bishop, I.D., Stock, C., Williams, K.J., 2009. Using virtual environments and agent models in multi-criteria decision-making. *Land Use Pol.* 26, 87–94.
 Bitsummit, 2019. Bitsummit. 2019.
 Blythe, J., Silver, J., Evans, L., Armitage, D., Bennett, N.J., Moore, M.-L., Morrison, T.H., Brown, K., 2018. The dark side of transformation: latent risks in contemporary sustainability discourse. *Antipode* 50, 1206–1223.
 Boin, A., Kofman-Bos, C., Overdijk, W., 2004. Crisis simulations: exploring tomorrow’s vulnerabilities and threats. *Simulat. Gaming* 35, 378–393.
 Bontoux, L., Bengtsson, D., Rosa, A., Sweeney, J., 2016. The JRC scenario exploration system - From study to serious game, 20, 93–108.
 Boot, W.R., Blakely, D.P., Simons, D.J., 2011. Do action video games improve perception and cognition? *Front. Psychol.* 2, 226–226.
 Bosch, M., Nekkers, J., Balian, Z.Z., 2019. Scenario’s - Samenleven 2030. Ministerie van Sociale Zaken en Werkgelegenheid.
 Buijsters, P.J., Buijsters-Smets, L., 2005. Papertoys: speelprenten en papieren speelgoed in Nederland (1640-1920)/Paper toys: playful pictures and paper toys in the Netherlands (1604-1920).
 Burch, S., Gupta, A., Inoue, C.Y.A., Kalfagianni, A., Persson, Å., Gerlak, A.K., Ishii, A., Patterson, J., Pickering, J., Scobie, M., Van der Heijden, J., Vervoort, J., Adler, C., Bloomfield, M., Djalante, R., Dryzek, J., Galaz, V., Gordon, C., Harmon, R., Jinnah, S., Kim, R.E., Olsson, L., Van Leeuwen, J., Ramasar, V., Wapner, P., Zondervan, R., 2019. New directions in earth system governance research. *Earth Sys. Govern.* 1, 100006.
 Cabinet of Japan, 2015. National Plan for Adaptation to the Impacts of Climate Change. In: Cabinet Decision on 27 November 2015 (Tokyo, Japan).
 Candy, S., 2018. Gaming Futures Literacy: the Thing from the Future, Transforming the Future (Open Access): Anticipation in the 21st Century, pp. 233–246.
 Canon Institute for Global Studies, F.A.a.N.S.G., 2017. The 25th CIGS Policy Simulation, The New Great Game in Eurasia: Eradicating IS and Dealing with Frequent Concurrent Crises, Summary Report and Assessment. In: Capcom Production Studio 4, (2001) (Phoenix Wright: Ace Attorney. Capcom).
 Centraal Bureau voor de Statistiek (CBS), 2018. Nederland Koploper in Europa Met. Internettoegang CBS.
 Chunsoft, 1995. Mystery Dungeon: Shiren the Wanderer. Chunsoft.
 Collins, R., 2004. Interaction Ritual Chains, STU - Student, edition ed. Princeton University Press, Princeton.
 CreaTures, 2021. Horizon 2020 CreaTures: Creative Practices for Transformational Futures.
 Crowe, N., Bradford, S., Hodgkinson, P., Deicke, W., Youth Cultures. Routledge., 2007. Identity and Structure in Online Gaming: Young People’s Symbolic and Virtual Extensions of Self. In: den Haan, R.J., van der Voort, M.C., Baart, F., Berends, K.D., van den Berg, M.C., Straatsma, M.W., Geenen, A.J.P., Hulscher, S.J.M.H. (Eds.) (2020) The Virtual River Game: Gaming using models to collaboratively explore river management complexity. Environmental Modelling and Software 134.
 Dolejšová, M., Ampatzidou, C., Houston, L., Light, A., Botero, A., Choi, J., Wilde, D., Bertran, F.A.A., Davis, H., Gil, F.G.G., Catlow, R., 2021. Designing for transformative futures: creative practice, social change and climate emergency, creativity and cognition. *Assoc. Comp. Mach. Virt. Event, Italy.* Article 3.
 Dolin, E.J., Susskind, L.E., 1992. A role for simulations in public policy disputes: the case of national energy policy. *Simulat. Gaming* 23, 20–44.
 Dryzek, J.S., 2009. Democratization as deliberative capacity building. *Comp. Polit. Stud.* 42, 1379–1402.
 Duffhues, J., Mayer, I.S., Nefs, M., Van Der Vliet, M., 2014. Breaking barriers to Transit-Oriented development: insights from the serious game SPRINTCITY. *Environ. Plann. Plann. Des.* 41, 770–791.
 Dunagan, J., 2012. Massively multiplayer futuring: IFTF’s foresight engine. *J. Futures Stud.* 17, 141–150.
 Dutch Game Garden, 2018. Dutch Game Garden Website.
 Dutch Games Association, 2019. Holland Pavilion Tokyo Game Show 2019.
 EAD, N., 2001. Animal Crossing. Nintendo.
 Eckstein, D., Hutflits, M.-L., Wings, M., 2019. Global Climate Risk Index 2019 - Who Suffers Most from Extreme Weather Events? Weather-Related Loss Events in 2017 and 1998 to 2017. Briefing Paper.
 Eisenack, K., Reckien, D., 2013. Climate change and simulation/gaming. *Simulat. Gaming* 44, 245–252.
 Erisman, J.W., Hensen, A., De Vries, W., Kros, H., Van de Wal, T.V., De Winter, W., Wien, J.E., Elswijk, M.V., Maat, M., Sanders, K., 2002. NitroGenius: a nitrogen decision support system: a game to develop the optimal policy to solve the Dutch nitrogen pollution problem. *Ambio* 31, 190–196.
 Eurostat, 2019. Listening to Music and Playing Games Online.

- Eurostat, 2020. Households: Levels of Internet Access. https://ec.europa.eu/eurostat/web/products-datasets/product?code=ISOC_CI_IN_H. Eurostat.
- Fuerth, L.S., 2009. Foresight and anticipatory governance. *Foresight* 11, 14–32.
- Fujimoto, T., 2007. Serious Games: Digital Games for Education and Society. Tokyo Denki University Press, Tokyo.
- Furuichi, S., 2017. The 1st Serious and Applied Game Summit in Tokyo (2017 Feb. 24), by DiGRA Japan (Education SIG) and Embassy of the Netherlands, Mediadesignlabs. Org.
- Garst, A., 2018. Inside Japan's Growing Indie Game Scene. *Variety*.
- Geller, R.J., 2017. Seismology: Japan must admit it can't predict quakes. *Nature* 545, 289.
- Ghosh, A., 2018. The Great Derangement: Climate Change and the Unthinkable. Penguin UK, London, UK.
- Global Industry Analysts, 2020. Global Video Games Industry. *GlobeNewsWire*.
- Goffman, E., 1956. The Preservation of Self in Everyday Life. Doubleday, New York.
- Granic, I., Lobel, A., Engels, R.C.M.E., 2014. The benefits of playing video games. *Am. Psychol.* 69, 66–78.
- Gupta, A., 2004. When Global Is Local: Negotiating Safe Use of Biotechnology. In: Jasanoff, S., Long-Martello, M. (Eds.), *In Earthly Politics: Local and Global in Environmental Governance*. MIT Press, Cambridge, pp. 127–148.
- Guston, D.H., 2014. Understanding 'anticipatory governance'. *Soc. Stud. Sci.* 44, 218–242.
- Guyot, P., Honiden, S., 2006. Agent-based participatory simulations: merging multi-agent systems and role-playing games. *JASSS* 9.
- Hajer, M.A., Pelzer, P., 2018. 2050—an energetic odyssey: understanding 'techniques of futuring' in the transition towards renewable energy. *Energy Res. Soc. Sci.* 44, 222–231.
- Hajer, M., Versteeg, W., 2019. Imagining the post-fossil city: why is it so difficult to think of new possible worlds? *Terri. Pol. Govern.* 7, 122–134.
- Hebinck, A., Vervoort, J.M., Hebinck, P., Rutting, L., Galli, F., 2018. Imagining transformative futures: Participatory foresight for food systems change. *Ecol. Soc.* 23.
- Hettinga, S., Boter, J., Dias, E., Fruijtier, S., de Vogel, B., Scholten, H., 2020. Urban energy transition in a gaming context: the role of children. *Land Use Pol.*
- Hooghiemstra, D., 2017. Gamification in Japan: a Critical Analysis, *Asian Studies*. University of Leiden, Leiden.
- Hosei University, 2018. Report on Local Climate Change Adaptation in Japan - toward Mainstreaming, English Edition. Tokyo, Japan.
- Ichikawa, A., 2014. Early Japanese gaming simulation efforts. *Develop. Bus. Simul. Experiential Learn.* 35.
- Kaji, H., Matsumura, K., Kaneda, T., Kanegae, H., Ishibashi, K., Yahagi, M., Mihira, J., 2005. Use of Gaming for Training Emergency Headquarters in Responding to Earthquake Damage: VEQRES/SAITAI—Virtual Earthquake RESponses—. *Gaming, Simulations, and Society*. Springer, Tokyo, pp. 29–38.
- Kamijo, Y., Komiya, A., Mifune, N., Saijo, T., 2017. Negotiating with the future: incorporating imaginary future generations into negotiations. *Sustain. Sci.* 12, 409–420.
- Kinnersly, O., 2019. Ducks, runes, and tired wizards: tabletop's legacy in Japanese video games. *WorkinJapan*. today.
- Kishimoto, Y., Furuichi, S., Mimaki, K., Ono, K., Aibara, M., 2017. History of serious game jam in Japan: from the 1st to the 5th event. *Digi. Game Sci.* 9, 57–62.
- Klerkx, L., Begemann, S., 2020. Supporting food systems transformation: the what, why, who, where and how of mission-oriented agricultural innovation systems. *Agric. Syst.* 184, 102901.
- Koei, 1990. Top Management. Koei.
- Kondo, K., 2019. Before the heat of the game. *Japan. J. Analog. Role-Play. Game Stud.* 1, 3–4.
- Koyama, Y., 2016. History of Japanese Video Game Industries. *Jinbunshoin*.
- Krauss, E.S., Pekkanen, R.J., 2010. The Rise and Fall of Japan's LDP: Political Party Organizations as Historical Institutions. Cornell University Press, Ithaca, NY.
- Kuboya, M., Kimura, S., 2005. The Game of "Forming a Coalition Government". *Gaming, Simulations, and Society*. Springer, Tokyo, pp. 11–20.
- Kurahara, D., Ono, K., 2016. Government PR Games. In: *The Internet Age - How Did the Ministry of Defense Produce the Serious Game "Self-Defense Forces Collection"?*. Tokyo Denki University Culture Research, Tokyo, pp. 219–224.
- Kurozawa, T., 2019. Development of business game in Japan and JASAG. *Stud. Simulat. Gaming* 28, 105–107.
- Lange, E., 2011. 99 volumes later: we can visualise. Now what? *Landsc. Urban Plann.* 100, 403–406.
- Lange, P., Driessen, P.P.J., Sauer, A., Bornemann, B., Burger, P., 2013. Governing towards sustainability—conceptualizing modes of governance. *J. Environ. Pol. Plann.* 15, 403–425.
- Lesschen, J.P., Reijs, J., Vellinga, T., Verhagen, J., Kros, H., de Vries, M., Jongeneel, R., Slier, T., Gonzalez Martinez, A., Vermeij, I., Daatselaar, C., 2020. Scenariostudie Perspectief Voor Ontwikkelrichtingen Nederlandse Landbouw in 2050 (Wageningen).
- Lewis, L., 2017. Game on: Why Japan's Arcades Are Still Winning. *Financial Times*, London.
- Loorbach, D., Frantzeskaki, N., Avelino, F., 2017. Sustainability Transitions Research: Transforming Science and Practice for Societal Change. *Annual Review of Environment and Resources*, pp. 599–626.
- Low, S., Schäfer, S., 2019. Tools of the trade: practices and politics of researching the future in climate engineering. *Sustain. Sci.* 14, 953–962.
- Maessen, L.M., 2019. Nederlandse Game Industrie Blijft Achter Bij Het Buitenland (Dutch Game Industry Lags Internationally, NRC. NRC, Rotterdam.
- Mair, S., Jones, A., Ward, J., Christie, I., Druckman, A., Lyon, F., 2018. A Critical Review of the Role of Indicators in Implementing the Sustainable Development Goals. *World Sustainability Series*, pp. 41–56.
- Mangnus, A.C., Oomen, J., Vervoort, J.M., Hajer, M.A., 2021. Futures literacy and the diversity of the future. *Futures* 132.
- Matsuhita, K., 2007. Environmental Governance Theory (In Japanese). Kyoto University Press, Kyoto.
- Mayama, T., 2018. History of decentralization and future local autonomy. *Cities and Govern.* 29, 1–6.
- Mayer, I.S., 2009. The gaming of policy and the politics of gaming: a review. *Simulat. Gaming* 40, 825–862.
- Mayer, I., Riedel, J.C.K.H., Hauge, J.B., Bellotti, F., De Gloria, A., Ott, M., Petersen, S.A., 2013. Serious games in a European policy context. *Lect. Notes Comput. Sci.* 307–320.
- Mayer, I., Bekebrede, G., Hartevelde, C., Warmelink, H., Zhou, Q., Van Ruijven, T., Lo, J., Kortmann, R., Wenzler, I., 2014. The research and evaluation of serious games: toward a comprehensive methodology. *Br. J. Educ. Technol.* 45, 502–527.
- Medema, W., Mayer, I., Adamowski, J., Wals, A.E.J., Chew, C., 2019. The Potential of Serious Games to Solve Water Problems: Editorial to the Special Issue on Game-Based Approaches to Sustainable Water Governance. *Water*, Switzerland, 11.
- Mendler de Suarez, J., Suarez, P., Bachofen, C., Fortugno, N., Goentzel, J., Gonçalves, P., Grist, N., Macklin, C., Pfeifer, K., Schweizer, S., Van Aalst, M., Virji, H., 2012. Games for a New Climate: Experiencing the Complexity of Future Risks. *Pardee Center Task Force Report*, Boston.
- Milkoreit, M., 2017. Imaginary politics: climate change and making the future. *Elementa: Sci. Anthropol.* 5.
- Milkoreit, M., 2019. Pop-cultural mobilization: deploying game of thrones to shift US climate change politics. *Int. J. Polit. Cult. Soc.* 32, 61–82.
- Ministry of Agriculture Forestry and Fisheries, 2010. Environmental Issues and Food, Agriculture and Rural Areas: Environmental Changes Have a Major Impact on Food, Agriculture and Rural Areas. In: *Ministry of Agriculture, Forestry and Fisheries*. MAFF, Tokyo, Japan.
- Ministry of Internal Affairs and Communication, 2016. Awareness Survey on the Right to Vote. *Ministry of Internal Affairs and Communication*.
- Ministry of the Environment, Ministry of Education, C., Sports, Science and Technology MECSST, Ministry of Agriculture, F.a.F.M., Ministry of Land, I., Transport and Tourism MLITT, JMA, J.M.A., 2018. Synthesis Report on Observations, Projections and Impact Assessments of Climate Change, Tokyo, Japan.
- Moore, M.-L., Milkoreit, M., 2020. Imagination and transformations to sustainable and just futures. *Elementa: Sci. Anthropol.* 8.
- Moosdorff, C., 2021. Depleted-symbol-induced exhaustion: why I can't play Disco Elysium anymore. *The Anticiplay project*. <https://anticplay.medium.com/depleted-symbol-induced-exhaustion-why-i-cant-play-disco-elysium-anymore-84f3fd4f4425>.
- Muiderman, K., Gupta, A., Vervoort, J., Biermann, F., 2020. Four approaches to anticipatory climate governance: Different conceptions of the future and implications for the present. *Wiley Interdiscip. Res. Clim. Change*.
- Mulgan, A.G., 2005. Japan's Interventionist State: The Role of the MAFF. *Nissan Institute Routledge Curzon Japanese Studies Series*, Abingdon, UK.
- Nakagawa, Y., Hara, K., Saijo, T., 2017. Becoming sympathetic to the needs of future generations: a phenomenological study of participation in future design workshops. *Work. Pap. SDES, Kochi Univ. Technol. School of Econ. Manag.* 2017-4.
- Nakamura, A., 2018. History of Chinese Game Industry (in Japanese) (Gz Brain).
- Navarro-Remesal, V., Loriguillo López, A., 2015. What makes gému different? A look at the distinctive design traits of the Japanese video games and their place in the Japanese media mix. *J. Games Criti.* 2.
- Neverland co. Ltd., 2006. Rune Factory. *Marvelous Entertainment*.
- NI Consulting, 2020. *SalesForceAssistant - Gamification*.
- Nintendo, 2005. *Dr Kawashima's Brain Training*. Nintendo.
- Nisbet, S., Williams, A., 2009. Improving students' attitudes to chance with games and activities. *Aust. Math. Teach.* 65, 25–37.
- Nishimura, K.G., 2012. Ageing, Finance and Regulations. *Bank of Japan Speech Joint Forum Meeting*, Tokyo.
- Nojions, B., 2021. Politicians Among Us: How Games Are Being Used to Reach Out to Potential Voters. *Anticiplay project*.
- Ota, K., (2018) *Serious Board Game Jam 2018. FEAST project*, Kyoto.
- Ogawa, A., 2009. Failure of Civil Society? the Third Sector and the State. *Contemporary Japan SUNY Press*, Albany, NY.
- Otsuki, S., Amano, K., Harada, M., Kitamura, I., Re, J., Sadaike, Y., Mimura, S., 2016. Development of SASKE-NABLE: A Simulation Game Utilizing Lessons from the Great East Japan Earthquake. , *Simulation and Gaming in the Network Society*. Springer, Singapore, pp. 323–337.
- Ouariachi, T., Elving, W., 2020. Accelerating the energy transition through serious gaming: testing effects on awareness, knowledge and efficacy beliefs. *Electron. J. e Learn.* 18, 410–420.
- O'Donnell, J., 2020. Militant meninism: the militaristic discourse of gamergate and men's rights activism. *Media Cult. Soc.* 42, 654–674.
- Pahl-Wostl, C., Becker, G., Knieper, C., Sendzimir, J., 2013. How multilevel societal learning processes facilitate transformative change: a comparative case study analysis on flood management. *Ecol. Soc.* 18.
- Parker, H.R., Cornforth, R.J., Suarez, P., Allen, M.R., Boyd, E., James, R., Jones, R.G., Otto, F.E.L., Walton, P., 2016. Using a game to engage stakeholders in extreme event attribution science. *Intern. J. Dis. Risk Sci.* 7, 353–365.
- Pereira, L., Asrar, G.R., Bhargava, R., Fisher, L.H., Hsu, A., Jabbour, J., Nel, J., Selomane, O., Sitas, N., Trisos, C., Ward, J., van den Ende, M., Vervoort, J., Weinfurter, A., 2021. Grounding global environmental assessments through bottom-up futures based on local practices and perspectives. *Sustain. Sci.*

- Picard, M., 2013. The foundation of Geemu: a brief history of early Japanese video games. *Game Stud.* 13.
- Ramos, J.M., 2014. Anticipatory governance: traditions and trajectories for strategic design. *J. Futures Stud.* 19.
- Ramos, J.M., Sweeney, J.A., Peach, K., Smith, L., 2019. Our Futures - by the People, for the People. How Mass Involvement in Shaping the Future Can Solve Complex Problems.
- Reckien, D., Eisenack, K., 2013. Climate change gaming on board and screen: a review. *Simulat. Gaming* 44, 253–271.
- Red Redemption, 2011. *Fate of the World*. Red Redemption, Oxford.
- Rich, M., 2016. The New York Times. (2016) A Morning Surprise for Japan: Shinzo Abe as Super Mario. *The New York Times*, New York.
- Ritzema, H.P., Van Loon-Steensma, J.M., 2018. Coping with climate change in a densely populated delta: a paradigm shift in flood and water management in The Netherlands. *Irrigat. Drain.* 67, 52–65.
- Rumore, D., Schenk, T., Susskind, L., 2016. Role-play simulations for climate change adaptation education and engagement. *Nat. Clim. Change* 6, 745–750.
- Sato, J., Sato, Jin, 2009. Environmental problems and the governance of knowledge: the powerlessness of experience and the recovery of tacit knowledge (in Japanese). *J. Environ. Soc.* 15, 39–53.
- Schechtman, M., 2012. The story of my (second) life: virtual worlds and narrative identity. *Philos. Technol.* 25, 329–343.
- Schinkel, A., 2005. Imagination as a category of history: an essay concerning Koselleck's concepts of *erfahrungsraum* and *erwartungshorizont*. *Hist. Theor.* 44, 42–54.
- Sekiguchi, A., Kawashima, Y., Deguchi, A., Okubo, T., 2016. Development of a digital sugoroku game "Satoyama Life · Admins" to support environmental learning. *Sci. educ. res.* 31, 99–102.
- Sengers, F., Wiczorek, A.J., Raven, R., 2019. Experimenting for sustainability transitions: a systematic literature review. *Technol. Forecast. Soc. Change* 145, 153–164.
- Silver, D., Schrittwieser, J., Simonyan, K., Antonoglou, I., Huang, A., Guez, A., Hubert, T., Baker, L., Lai, M., Bolton, A., Chen, Y., Lillicrap, T., Hui, F., Sifre, L., van den Driessche, G., Graepel, T., Hassabis, D., 2017. Mastering the game of Go without human knowledge. *Nature* 550, 354–359.
- Siwek, S.E., 2017. Video Games in the 21st Century: the 2017 Report. Entertainment Software Association.
- Sjöblom, B., 2015. Killing Digital Children. Design, Discourse, and Player Agency. In: Mortensen, T.E., Linderoth, J., Brown, M.L. (Eds.), *The Dark Side of Game Play. Controversial Issues in Playful Environments* 1ed. Routledge Abingdon, UK.
- Smith, R., 2009. The long history of gaming in military training. *Simulat. Gaming* 41, 6–19.
- Sociaal en Cultureel Planbureau (SCP), 2019. *De Sociale Staat van Nederland 2019* Sociaal en Cultureel Planbureau. Den Haag.
- Squire, K., 2005. Game-based Learning, an X-Learn Perspective Paper.
- Steffen, W.e.a., 2015. Planetary boundaries: guiding human development on a changing planet. *Science* 347.
- Stockwin, J.A.A., 2005. Governance, Democracy and the Political Economy of the Japanese State. In: Hook, G.D. (Ed.), *Contested Governance in Japan: Sites and Issues*. Routledge Curzon, Abingdon, UK, pp. 54–70.
- Stover, W.J., 2005. Teaching and learning empathy: an interactive, online diplomatic simulation of Middle East conflict. *J. Polit. Sci. Educ.* 1, 207–219.
- Strange Loop Games, 2018. *Eco. Strange Loop Games*.
- Tamura, H., 2016. A Brief History of Tabletop Wargaming in Japan: 1972–2012.
- Thompson, K.A., 2021. *Utopia after the Disco Age*. Anticoplay project. <https://anticoplay.medium.com/utopia-after-the-disco-age-a5722c03cfc4>.
- Transmango, 2018. *The Transmango Game Jam Tour*.
- Tygron, 2017. *Tygron - Next Generation Planner*. Tygron.
- Urranaka, T., Ando, R., 2018. *Japan's Pachinko Industry Braces for Anti-addiction Regulation*. Reuters, London.
- Van Asselt, H., 2016. The role of non-state actors in reviewing ambition, implementation, and compliance under the Paris agreement. *Clim. Law* 6, 91–108.
- van Asselt, M.B.A., Faas, A., van der Molen, F., Veenman, S.A., 2010. *Uit Zicht: Toekomstverkenningen Met Beleid (WRR-Verkenning Nr. 24, 2010)*. WRR-Verkenning. Wetenschappelijke Raad voor Regeringsbeleid, Amsterdam.
- van den Broek, A., Gieles, Y., 2018. *Het Culturele Leven - 10 Culturele Domeinen Bezien Vanaf 14 thema's/The Cultural Life - 10 Cultural Domains Seen from 14 Themes*. Sociaal en Cultureel Planbureau, Den Haag.
- Van Der Brugge, R., Rotmans, J., Loorbach, D., 2005. The transition in Dutch water management. *Reg. Environ. Change* 5, 164–176.
- van Pelt, S.C., Haasnoot, M., Arts, B., Ludwig, F., Swart, R., Biesbroek, R., 2015. Communicating climate (change) uncertainties: simulation games as boundary objects. *Environ. Sci. Pol.* 45, 41–52.
- van Sluisveld, M.A.E., Harmsen, M.J.H.M., van Vuuren, D.P., Bosetti, V., Wilson, C., van der Zwaan, B., 2018. Comparing future patterns of energy system change in 2 °C scenarios to expert projections. *Global Environ. Change* 50, 201–211.
- van Zoet, D.J., 2019. *Spelen met koloniaal verlangen. Koloniale nostalgie in Nederlandse bordspellen uit de periode 1874-2017/Playing with colonial desire. Colonial nostalgia in Dutch Board games in the period 1874-2017*. In: MSc Thesis for History: Education and Communication. University, U., Utrecht.
- Veraart, F., 2011. Losing meanings: computer games in Dutch domestic use, 1975-2000. *IEEE Ann. Hist. Comput.* 33, 52–65.
- Vervoort, J.M., 2019. New frontiers in futures games: leveraging game sector developments. *Futures* 105, 174–186.
- Vervoort, J.M., 2021b. **OBJECTION! Help us build a courthouse climate game where you sue the powerful.** Anticoplay project. <https://anticoplay.medium.com/objection-he-lp-us-build-a-courthouse-climate-game-where-you-sue-the-powerful-ebe538772c90>.
- Vervoort, J.M., 2021a. **Games and sustainability transformations: a new paradigm.** Anticoplay project. <https://anticoplay.medium.com/games-and-sustainability-transformations-a-new-paradigm-1183965cab52>.
- Vervoort, J.M., Bendor, R., Kelliher, A., Strik, O., Helfgott, A.E.R., 2015. Scenarios and the art of worldmaking. *Futures* 74, 62–70.
- Vervoort, J., Gupta, A., 2018. Anticipating climate futures in a 1.5°C era: the link between foresight and governance. *Curr. Opin. Environ. Sustain.* 31, 104–111.
- Vervoort, J.M., Thornton, P.K., Kristjanson, P., Förch, W., Ericksen, P.J., Kok, K., Ingram, J.S.I., Herrero, M., Palazzo, A., Helfgott, A.E.S., Wilkinson, A., Havlík, P., Mason-D'Croz, D., Jost, C., 2014. Challenges to scenario-guided adaptive action on food security under climate change. *Global Environ. Change*.
- Wakita, K., 2015. *Diverse Communication in Local Environmental Governance (in Japanese)*. Setagaya Institute for Local Government Policy.
- Wiebe, K., Zurek, M., Lord, S., Brzezina, N., Gabrielyan, G., Libertini, J., Loch, A., Thapa-Parajuli, R., Vervoort, J., Westhoek, H., 2018. Scenario Development and Foresight Analysis: Exploring Options to Inform Choices. *Annu. Rev. Environ. Resour.*
- Wiering, M.A., Arts, B.J.M., 2006. Discursive shifts in Dutch river management: 'Deep' institutional change or adaptation strategy? *Hydrobiologia* 565, 327–338.
- Wilkinson, A., Kupers, R., 2014. *The Essence of Scenarios: Learning from the Shell Experience*. Amsterdam University Press, Amsterdam.
- Wittgenstein, L., 1953; 2009. *Philosophical Investigations*. Wiley and Sons, Hoboken, NJ.
- Wu, J.S., Lee, J.J., 2015. Climate change games as tools for education and engagement. *Nat. Clim. Change* 5, 413–418.
- Yamakoshi, 2020. *The Changing Face of NGOs in Japan*. GDRC.
- Yoshida, H., 2017. *Gameplay as <Resistance>: for game-like realism 2.0 (in Japanese)*. *Eureka* 49, 141–152.
- Zhou, Q., Mayer, L.S., 2017. *Models, Simulations and Games for Water Management: A Comparative Q-Method Study in The Netherlands and China*, vol. 10. Water, Switzerland.