



HAL
open science

Mosaic glimpses: Serious games, generous constraints, and sustainable futures in Kandal, Cambodia

Jean-Philippe Venot, Casper Bruun Jensen, Etienne Delay, William'S Daré

► To cite this version:

Jean-Philippe Venot, Casper Bruun Jensen, Etienne Delay, William'S Daré. Mosaic glimpses: Serious games, generous constraints, and sustainable futures in Kandal, Cambodia. *World Development*, 2022, 151, pp.105779. 10.1016/j.worlddev.2021.105779 . hal-03707134

HAL Id: hal-03707134

<https://hal.inrae.fr/hal-03707134v1>

Submitted on 28 Jun 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial - NoDerivatives 4.0
International License



Mosaic glimpses: Serious games, generous constraints, and sustainable futures in Kandal, Cambodia



Jean-Philippe Venot ^{a,*}, Casper Bruun Jensen ^b, Etienne Delay ^c, William's Daré ^c

^a UMR G-EAU (IRD, Université de Montpellier), France

^b Independent researcher, Cambodia

^c UMR SENS (CIRAD, Université de Montpellier), France

ARTICLE INFO

Article history:

Accepted 1 December 2021

Available online 5 January 2022

Keywords:

Development

Participation

Landscape transformation

Technologies of humility

Mekong

Cambodia

ABSTRACT

This paper uses a series of serious games – a form of participatory modelling designed and played in Kandal, Cambodia – as an entry point for reexamining relations between development projects, participatory formats, landscape transformations, and sustainable futures. Critics of development and participation have shown that participatory formats simplify real-world complexities by rendering them technical. This is also the case for serious games. But contrary to what is often assumed, 'depoliticization' is not the unavoidable outcome. Instead, participatory outcomes depend on specific sociotechnical patterns of more or less generous constraints. To support collective exploration requires tinkering with these patterns of constraints to keep the boundaries between virtual and real worlds, insiders and outsiders, and the present and future relatively permeable. Generous constraints and permeable boundaries do not keep power out of participation but facilitate glimpses of different possibilities. In Kandal, they made it possible to shift from narrow technical discussions on the rehabilitation of specific preks (water channels) towards a collective exploration of sustainable futures for the full mosaic landscape. In general, we argue, serious games hold potentials as experimental systems, which are serious to the extent that they work like technologies of humility. In this capacity, they can support efforts to do difference together, and explore more-than-human worlds and divergent practical ontologies. Learning from this multiplicity matters for moving towards sustainable forms of living in Kandal and elsewhere.

© 2021 The Author(s). Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Jean-Philippe Venot [Researcher at the French Institute for Sustainable Development - IRD]:¹

I would just like to know where you are at as far as the preks are concerned . . . On this basis, I can "pilot test" the tools we developed in the area you identified in the inception report . . . this could constitute the basis for another way to approach the preks.

Dan Bruins [senior international expert leading team 1]:

The trouble I see here is that this is not a game; there is already an experienced team that is employed to do this [identify interventions for prek *rehabilitation*] and is doing it . . . and it is work and a responsibility.

Jean-Philippe Venot:

I am not proposing "we just play around." I just think that the tools we developed (even if they may appear to be not really serious) can actually help WAT4CAM implementation. . . If we do not do it now, we all know how it will end up. The pressure to "deliver" will mean that people will do what they best know . . . Given the complexity of the preks, this will lead to very similar mistakes. Experimenting now may yield practical things that the Technical assistance team 1 and 2 will be able to act upon later.

Jan Shiller [senior international expert leading team 2]:

1) I also think the word 'game' is very misleading . . . 2) The reason I support this activity is not because I like the 'game' but purely that in my mind a master plan should definitely be fully participative in set-up, and cover all stakeholders and involved institutions . . .

* Corresponding author.

E-mail address: jean-philippe.venot@ird.fr (J.-P. Venot).

¹ Apart from the authors, all names have been changed.

These excerpts are from an email conversation between the first author (henceforth JPV) and the lead experts of two technical teams assisting the implementation of an AFD-funded project (WAT4CAM) in support of the Cambodian irrigation sector.² The topic was the potential relevance and value of ‘experimenting’ with actively involving farmers in discussions regarding the *preks*, a Khmer term for the many earthen canals that crisscross Kandal province and give shape to its mosaic landscape (Fig. 1). Since the mid-2000s, several development agencies and ministries have carried out projects to ‘rehabilitate’ these canals (Venot and Jensen, 2021).

JPV sent out the email in July 2020 at an opportune moment, roughly five years after first encountering the *preks* as part of a research project.³ AFD’s previous WASP project had ended, and since WAT4CAM was still in the initial phase and had no fixed approach, there was a window of opportunity for making the new technical teams interested in unorthodox possibilities, such as bringing so far missing constituents like farmers or fishermen to the table in discussions about how to think of the *preks* and the mosaic landscape. Perhaps *serious games*,⁴ a participatory format we already used in our research, might generate alternative scenarios for sustainable, more-than-human landscape transformations.

We begin with this exchange about serious games since it vividly illustrates the fraught relations between development, participation and power, and between technical expertise and local knowledges. Because the proposal was immediately challenged. The issues and responsibilities are *too serious* for games, argued one technical expert. Talking of games is *very misleading*, opined another, intimating that it might delegitimize the project approach. Even so, researchers and technical assistance teams hosted their first (and, so far, only) co-designed game session with farmers and local decision-makers in Kandal about a month later (Fig. 1).

In the following, we use serious game sessions as an entry point for rethinking the possibilities and problems of participatory formats. We engage these games as a particular kind of ‘hybrid forum’ with the *potential* to operate as technologies of humility rather than of hubris (Jasanoff, 2004; Jensen, 2005)⁵ and we analyze these potentials as *consequent upon patterns of more or less generous constraints* (Gomart, 2002). The relative success of participatory games appears as an experimental achievement, which depends on tinkering with constraints to keep the boundaries between virtual and real

worlds, experts and locals, insiders and outsiders, and the present and future *permeable*.

1. Development, participation, and the problem of constraints

Since the 1990s, development and participation have both been subject to heated debate and critique. Development projects were described as dependent on actively ‘unknowing’ contexts and rendering all problems ‘technical’ (Ferguson, 1990; Li, 2007). This depoliticized many of the central issues and created lacunae of accountability.

While diverse participatory approaches aimed to address these problems, they gave rise to another set of critiques. Centrally, they were criticized for inattentiveness to, or naivety with respect to, inequality, oppression, and power (Cooke & Kothari, 2001; Hickey & Mohan, 2004: 11). It was also suggested that the radical emancipatory potentials of participation evaporated as these approaches became one among many instruments within the ‘toolbox’ of development agencies. Participation appeared as depoliticization in a more appealing guise.

Since WALRUS1 (Water and Land Resource Utilization Simulation), which was developed to facilitate interactions about water and land resource usage in the early 1970s (Wesselow & Stoll-Kleeman, 2018), there have been experiments with participatory games in various “modeling with stakeholders” approaches, including in development contexts (Voinov & Bousquet, 2010). The general aim is to facilitate collective exploration of complex problems (Barreteau et al., 2021) in virtual settings carefully designed to avoid, or at least minimize, existing power relations and conflicts. One of these approaches, Companion Modelling- ComMod- (Barreteau et al., 2003; Etienne, 2014), informed the serious games that we designed and played in Kandal.

While serious games have been developed somewhat to the side of the critical debates on participation, participatory modelers are attentive to many similar issues and their discussions contain indirect responses to several central objections (Barnaud and van Paassen, 2013; Jordan et al., 2018). Some reflect on how games can be designed to avoid reinforcing conflicts and existing relations of domination (Barnaud & Van Paassen, 2013; Bécu et al., 2008; Mathevet et al., 2014). Others argue for attentiveness to the dominant roles and postures of facilitators and modelers (Barreteau et al., 2003; Jonsson et al., 2007), or invoke “ethics” as protection against the risk of manipulation (Barnaud et al., 2008; Halbe et al., 2018). A recent overview recognizes “potential biases” and recommends identification of “power relationships, social values and epistemologies of participants” (Barreteau et al., 2021). Some even ponder whether participatory modeling will ever be ‘truly’ participatory (Jonsson et al., 2007).

At the same time, however, two tenets are advanced about the distinctiveness of participatory modeling and serious games vis-à-vis other participatory formats. The first claim about *difference* hinges on a displacement of where participation takes place. Because contrary to other formats, participation is not only a matter of participating in activities designed by ‘outsiders’ but also of involvement in the design and redesign of the participatory tools themselves. The second claim is that power relations can be prevented from corrupting serious games by carefully maintaining *distance* from the real world (Daré & Barreteau, 2003; Patamadit & Bousquet, 2005). This is what allows the games to ‘work’ as participatory experiments.

It follows from these two ‘central dogmas’ that critiques that might well apply to other kinds of participation are irrelevant for serious games. The problems of simplification and domination involved in “rendering technical” have been solved by involving participation at the level of design and by loosening power relations through ‘distance.’

² The “Water Resources Management & Agricultural Transition for Cambodia Project” (WAT4CAM) is a 200 Million Euros, six-year project (2019–2025), co-funded by the French Agency for Development (AFD) and the European Union (EU) and implemented by the Cambodian Ministry of Water Resources and Meteorology (MoWRAM) and the Ministry of Agriculture, Forestry and Fisheries (MAFF) in five provinces. It builds on the earlier Water and Agricultural Sector Project (WASP 2014–2019). The email exchange happened 2 years after a prefeasibility study had been submitted to AFD, since it took 18 months to finalize the project and recruit the technical assistance teams. None of the authors have had any economic relation with AFD or either of these projects.

³ Between 2016 and 2019, the authors received funding from the French National Research Agency (ANR) and the Japan Society for the Promotion of Science (JSPS) (see <https://delta.hus.osaka-u.ac.jp/> and <https://deltasoutheastasia-doubt.com/>). Research activities involved collaboration with Cambodian partners from the Royal University of Agriculture (RUA) and the NGO Irrigation Service Center (ISC). They also came to include frequent informal interactions with AFD’s staff and technical teams.

⁴ We use the terms ‘games’, ‘serious games’ and ‘participatory games’ more or less interchangeably. The games are said to be *serious* because they deal with ‘real world issues’ and to be *participatory* because multiple actors are involved in design and play. We do not use the common term ‘role-playing game,’ because it focuses attention on a single element of game dynamics - the roles that players assume.

⁵ Hybrid forums are open spaces where heterogeneous groups (from experts to laypeople) can come together to discussion technical options and decisions that collectively affect them (Callon et al., 2001: 18). Sheila Jasanoff (2004) distinguishes between modes of expertise as either technologies of hubris or humility depending on whether they focus on the known at the expense of the unknown and avoid challenges to their framing assumptions (239) or grapple with “the unknown, the uncertain, the ambiguous, and the uncontrollable” (227).



Fig. 1. A *prek* in the mosaic landscape of in Kandal (left) and discussion around a *serious game*, Kandal province, August 2020 (right) (The Authors).

Participatory critics might well reply that these precautions are not sufficient to immunize serious games against charges of depoliticization. After all, there are still implicit, framing assumptions, the games still simplify complex problems, and they render those problems technical in many ways. For example, although participants are given room to question and even modify game design (Daré & Barreateau 2003; Patamadit & Bousquet 2005), it happens against a backdrop of ideas, rules, and more or less explicit objectives defined by researchers or development experts during preparatory workshops where the participants are often absent.

The present inquiry is distinguished both from the critiques of development and participation that center on depoliticization and from the participatory gaming literature that emphasizes the potentials of the approach. For the former, it often seems unnecessary to examine participatory processes and effects in much detail because it is (by now) taken as given that “rendering technical” invariably results in depoliticization. The latter is seldom interested in the politics of technicalities and assumes that formal companion methodologies guarantee participatory ends. These are very different perspectives but, in consequence of their shared lack of curiosity about the socio-technical patterns of constraints that actually shape participatory processes and outcomes, they end up as strange bed-fellows. As interest in those patterns and their effects are evacuated from both sides, serious games remain tightly black-boxed.

Rather than deflecting the participatory critiques, this paper embraces them. But it does so only as a starting point, in order to move elsewhere. Thus, we affirm that serious games *undeniably* formalize, simplify, and ‘render technical’ in many different ways, including by constraining players. But this does not unavoidably compromise their participatory potentials. It just means that those potentials, rather than general and methodological, hinge on the specific patterns of constraints at play in the games. Ironically, it follows that critiques based on ‘what we all know’ about simplification and depoliticization, elite capture and marginalization, etc. *in general* are too reductive and formulaic to have much purchase.

In the rest of this article, we take the serious games designed and played in Kandal from 2016 onwards—around the same time as AFD engaged in *prek* rehabilitation—as an entry point for tackling relations between development agendas, “rendering technical,” and participatory politics in a way that avoids the oppositions sketched above. We explore the games as hybrid forums, which can *potentially* support collective deliberations and speculations about landscapes and livelihoods. To understand those potentials and their obstacles, we *enter the black-box* and inspect patterns of more-or-less generous constraints (Gomart 2002, 2004).

We begin by describing negotiations with different partners about several kinds of constraints relating to the design of the game board. We briefly depict how social constraints and power relations entered game sessions. But we are particularly interested in other glimpses of possibility *also* elicited in the games. Those glimpses keep alive the possibility that serious games *can* work as technologies of humility even in difficult development contexts.

2. Generous constraints and permeable boundaries

Over the last decade, some researchers sought to loosen the stark contrasts and dichotomies that structured the early controversies around participation (e.g. Yarrow & Venkatesan, 2012; Jensen and Winthereik, 2013). The anthropologist Maia Green (2010: 9) pointed out that the critiques were often less about participation as an ideal than about failure to uphold it in the context of specific projects and power relationships. Despite widespread recognition that participatory methods do not live up to the ideal in practice, she also noted their continued popularity, both among development organizations and aid recipients.

Green ascribed this popularity to the capacity of participatory forms to operate as “boundary objects” (Star and Griesemer, 1989); more or less tangible devices that facilitate temporary collaborations between different communities. In fact, participatory modelers also occasionally characterize their artefacts and techniques as boundary objects (Voinov et al., 2016: 13). There are some important differences, however.

Participatory modelers work with a normative, methodological framework in which games *must be* boundary objects *because* they are designed with diverse participants and divergent viewpoints can be in principle kept intact due to ‘distance’ from reality and its power relations. In contrast, Star and Griesemer (1989) empirically examined what allowed particular things to *actually operate* as boundary objects within particular collaborative contexts.

This non-normative approach paves the way for exploring serious games not only as *part of* heterogeneous networks (of e.g. funding agencies, project documents, technical experts, researchers, NGOs, government partners, farmers and fishermen) (Barreateau et al., 2014) but as networks *in their own right*. Serious games appear as open-ended experimental systems populated by players who are *constrained* in numerous—more or less technical and non-technical—ways. Some constraints relate to technical features and ‘pre-defined scenarios.’ Some concern procedures and rules. Others relate to the practical and social conditions under which games are designed and played and to the ‘objectives’

assigned by facilitators based on their 'expert knowledge.' And these diverse constraints by design are complemented by yet others, which are negotiated by players or emerge haphazardly during game sessions.

To critics, this will sound as another version of simplifying complex, power-laden social realities by rendering them technical. But paradoxically this is a simplified and reductive understanding of constraints. For as we shall see, constraints are not necessarily repressive, and not in the same ways. They are not always introduced by the most powerful agents. And while they do simplify, they are not only reductive.

In support, we might recall Paul Feyerabend's (1993: 72) observation that scientific progress itself depends on constraints put in place by a "specified and well-entrenched" framework. But we draw specific inspiration from the concept of *generous constraints* developed by the medical sociologist Emilie Gomart's (2002, 2004) in elaboration of Michel Foucault's famous analyses. Foucault (1973, 1977), of course, was fascinated by how institutional settings shape configurations of knowledge and power. Sick bodies are organized in hospitals, students are made obedient at school, and soldiers are disciplined in barracks. But as Gomart (2004: 99) reminds us, even while soldiers become "docile," they also become more "competent." School children are rendered obedient, yet at the same time they become more "vigorous" (99).

This makes little sense if one thinks of 'freedom' as the absence of external obstacles to action. If agency is diminished whenever an exterior force impinges on the subject, institutional ensembles like schools and prisons—or participatory development formats—can only appear as spaces of coercion, oppression, or subjugation. But if agency is viewed as emergent, distributed and shareable, the situation looks different. Once it is recognized that agents are always constrained, the obsession with *whether or not* that is the case fades in importance. Instead, what matters is careful examination of the relational qualities of specific patterns of constraints: do they merely isolate and reduce, or might they also engender new associations and possibilities for change? In place of a general critique of technical simplifications we are encouraged to tinker, add, and vary constraints in an experimental search of conditions that might generously "do a little more than oppress the user" (Gomart 2002: 517).

Across very different empirical settings, there is broad alignment between these characterizations and Maia Green's observation that 'local people' often use participatory forms productively to achieve their own ends, including ends of self-transformation. As we continue to discuss, refraining from reducing constraints to their repressive aspects makes it possible to understand the reciprocal construction of games and participants, objects and subjects.

In our case, this also requires grappling with the permeability of boundaries.⁶ Because, contrary to the introductory email exchange, which proceeded on the assumption that a single, rigid line separates unserious games from the real and serious development project, we are confronted with several power-laden and transformable relations.

Some anthropological analyses provide a vantage point for engaging these issues. Clifford Geertz (2005) famously analyzed Balinese cockfights as involving spectators and gamblers in "deep play." These fights do take place, cocks maim and kill each other, and substantial amounts of money are gambled away. This really happens, but within a highly circumscribed *game space* where regular conventions of behavior are suspended and actions have no significant external repercussions. Yet, despite the lack of 'real con-

sequences,' the games are very serious in moral and symbolic terms. For contrast, consider, Gregory Bateson's (1987: 59) discussion of dogs playfully fighting. The constraints of the *play world* prevent the dogs from seriously harming each other, but the fighting skills they acquire are real and serious, and they stay with them long after play has ended. Both cases exhibit the creative potentials of temporary immersion in a 'virtual world.' They make clear that a boundary is *prerequisite* for there to be 'a game' but also that their 'seriousness' depends on it being neither too fixed nor too rigid.

A similar premise undergirds serious games, which aim to create "synergy between real and virtual contexts, the one highlighting the other and *vice-versa*" (Daré and Barreteau, 2003). But this cuts several ways. For companion modelers, games are serious because they make it possible to address complex real-world problems and trigger collective learning. Speculative leeway is facilitated by ensuring that there is enough distance between game scenarios and reality to prevent the latter from overdetermining the former. In contrast, as we shall see, participants often view games as serious if they resemble reality sufficiently to make it possible to voice real concerns and oppose developments that seem only too likely to happen.

This means that the question of generous constraints is somewhat more complicated than in Gomart's original case of drug users entering a clinic. This scene was characterized by two general kinds of subject positions—staff or user—and a loosely shared trajectory towards rehabilitation. Although negotiated and varied in practice, the constraints were almost exclusively introduced by the clinic. In contrast, the serious games played in Kandal involve permeable boundaries, numerous incongruent subject positions, and widely divergent interests in *prek* rehabilitation. Moreover, while most constraints were initially defined by researchers and their partners, they were added to and modified by players, who showed considerable creativity in making the constraints more generous for themselves.

For serious games to have a chance to operate as technologies of humility for envisioning different kinds of more-than-human landscapes, those tensions and complications have to be continuously handled. Collective speculations and differently oriented explorations must be allowed to mingle, and leakage into the landscape must be supported in full recognition that everybody is not in (to) the process for the same reasons.

3. Discovering the *preks*

At the Cambodian capital Phnom Penh, the Bassac river branches out. For around 70 km, until the Vietnamese border, it runs alongside the Mekong mainstream across Kandal province. In the wet season, the floodplains are submerged under several meters of water except for narrow strips of land along the main river levees. When the water recedes, a mosaic landscape made of small cultivated fields progressively emerge.

Central to this unique, multi-use ecosystem are *preks*—earthen channels 10 to 50 m wide, several meters deep, and a few kilometers long—that run perpendicular from the main rivers (Mekong and Bassac). They 'end' in low-lying areas known as *boeuings*, which sustain productive small-scale capture fishery during the flood season and rice farming during the dry season. Close to the main river levees, farmers cultivate fruit trees, sugarcane, beans and vegetables in small fields called *chamkar* that are seldom flooded.

In the 1990s, this mosaic landscape was rediscovered as one of the "most productive farming system [...] in the whole of Cambodia" (JICA, 1998: 58). Our research showed that development projects that had been implemented in the area almost exclusively centered on increasing agricultural outputs by excavating *preks* that had silted up and by building sluice gates to enhance water

⁶ In line with the observation that: "the concept of the boundary is one of the least subtle in the social science repertoire" (Strathern 1996: 520).

control (Venot and Jensen, 2021). People living by the *preks* had hardly been involved, and rather complex engineering interventions had been carried out based on sparse hydrological knowledge. In some cases, infrastructures collapsed almost as soon as they were built.

As part of our research, we wanted to challenge and expand this narrow focus.

From a livelihood perspective, we worried that agricultural intensification would mainly benefit wealthier (*chamkar*) farmers and adversely affect smallholders and capture fishermen. In line with social and ecological critiques of hard infrastructure solutions for delta management (Wesselink et al., 2015; WWAP (United Nations World Water Assessment Programme)/UN-Water, 2018), we also wanted to explore 'nature-based' solutions able to sustain multiple more-than-human worlds and practices. For these reasons, our preferred unit of analysis was landscape transformation rather than single *preks*.

Against this background, we imagined that playing serious participatory games would allow us to learn about the many relations that make up the mosaic landscape. Game sessions could be imagined as "hybrid forums" (Callon et al., 2001) for collective articulation of alternative possibilities to landscape transformations, which might help to push development interventions in more sustainable directions.

Accordingly, we hoped to involve a range of 'local people' impacted by on-going *prek* rehabilitation projects. But as foreigners and newcomers we knew little about the intricacies of their affairs, conflicts, and aspirations, or how they shaped existing relations along the *preks*, not to mention with diverse outsiders to the mosaic landscape, like politicians, businesses, NGOs, and development agencies. Conversely, the 'locals' were similarly ignorant of our quite heterogeneous relations. Among those were the difference in orientation between AFD's technical teams, mainly engineers, who had been hired to rehabilitate the *preks*, and our research team, a mixed group of university-based researchers working on water and infrastructure issues.⁷

These brief descriptions only touch the surface of those complex relations. Even so, they should make clear that the contexts in which the serious games were designed and played are inadequately understood with reference to general dichotomies such as 'locals' and 'outsiders,' 'Cambodians' and 'foreigners,' or 'experts' and 'participants.' Instead, they took place in a context of numerous *permeable boundaries* and *shifting alignments of interests*, including our interest in influencing AFD's agenda for *prek* rehabilitation.

4. Setting (generous) constraints

The development of serious games was an iterative process. Starting in 2018, researchers from two French research institutes were involved in five 'game sessions,' each lasting one or two days. Before each session, objectives, rules, and tools were collectively defined with Cambodian partners from RUA and ISC in 'preparatory workshops' lasting three to five days.

The games, which differed between sessions, were played several times and modified with diverse participants including farmers-cum-fishermen, village chiefs, commune officials, ministerial staff, district and provincial administrations officials, staffers from NGOs and development agencies, and researchers (See Fig. 2 for a timeline).

⁷ Among the researchers there were further differences. Some were experts in Companion Modeling, and we adopted the approach due to their expertise in light of the transformative ambition of the DoUbT research project. For others, ComMod was not a central research identity, and the approach offered simply an interesting avenue of exploration.

The transformative component of the research project entailed numerous practical engagements with actors who had a role in shaping the mosaic landscape. In particular, there was a significant overlap between our *research topics*—water management, agriculture, infrastructure, and landscape transformation—and AFD's *practical efforts* to rehabilitate the *preks*. Accordingly, we interacted frequently with the WASP and WAT4CAM technical teams and AFD officials and we invited them as participants to game sessions from early on.

By the summer of 2020, the situation was changing. The WASP project had come to an end and WAT4CAM was still at an early stage. In the gap between these two projects, we perceived a margin of maneuver for influencing the new project to take a broader view of landscape rehabilitation. One way to do so might be to directly involve the new technical experts in serious game design and play. With skill and some luck, perhaps scenarios from the game sessions could lead to a broader interest in the landscape. The email exchange with which we began initiated this attempt and led us to co-design a game session with AFD 'experts.'

The games were played on a 'board' (e.g. a mosaic of colored or plain plywood 'tiles' - Figure 1 - or a large plastic tarpaulin - top left panel of Figure 3), which represented different types of land located alongside a single *prek* or by a network of *preks*. Vignettes represented the most common crops found in the area (mango, vegetables, rice, etc. - top middle panel of Fig. 3) and action cards represented 'interventions' (infrastructure construction, excavation of *preks*, training of farmers, etc. - see top right panel of Fig. 3).

In the games, players assumed different roles, like 'farmer' or 'official.' They were assigned different 'loose' objectives relating to e.g. increasing agricultural or fishery production or ensuring the 'satisfaction' of the population (for an example, see the bottom left panel of Figure 3). These objectives could be achieved by placing vignettes and cards on the board and thereby modifying the *prek* system we had set up. Facilitators had pre-identified crops and possible interventions, but blank cards made it possible for players to add new elements. Some rules varied between game sessions, for example to explore differences between individual and collective decisions (which we assumed would facilitate the emergence of more equitable and environmentally sustainable future scenarios for the *prek* mosaic).

Behind the game play, a range of decisions about the effects of various 'events' (e.g. floods, droughts) and interventions (e.g. construction of infrastructure) on indicators like agricultural production, fish population, or 'satisfaction' had been "rendered technical" in so-called calibrations. The purpose of these calibrations was not to quantify the actual impact of e.g. building a sluice gate, which would in any case be impossible. Instead, they reflected qualitative knowledge and broad estimates based on our research. Thus, building a sluice gate might lead to a 3 unit increase of agricultural production in the *chamkar* and a 2 unit increase in the *boeung* (due to improved water control), while decreasing fish population by 2 units (due to impeded water flows) (for the effects of building a sluice gate, see the top right panel of Fig. 3).⁸

Indicators were also adjusted for flooding. For example, if an 'extreme flood' occurred where a sluice gate had been built, *chamkar* production would decrease by 5 units rather than increase by 3. Such numbers strung together an array of assumptions. First, it was assumed that the building of a sluice gate would provide farmers with a sense of security and lead to intensified agriculture. Hence, the 3 unit increase during a normal flood. However, if a flood dam-

⁸ The game 'units' did not have any equivalent in the 'real' world (such as tons, bags) but were meant to represent concepts such as production, income, etc. How a specific intervention impacted each indicator was shown on the corresponding action card (Figure 3) and materialized by tokens on the board.

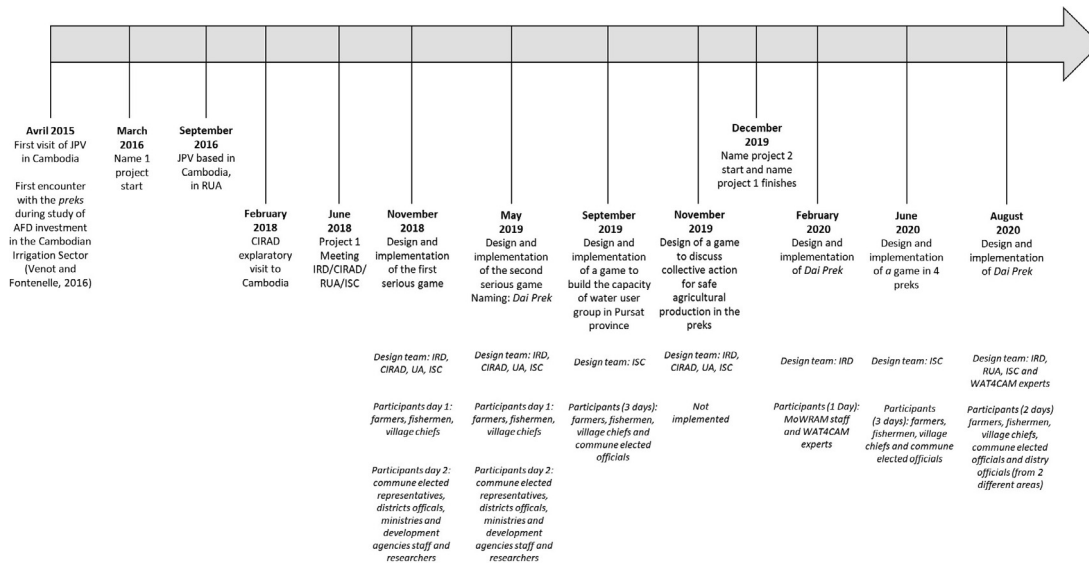


Fig. 2. Research and Engagement: Timelines of game sessions.(See below-mentioned references for further information.)

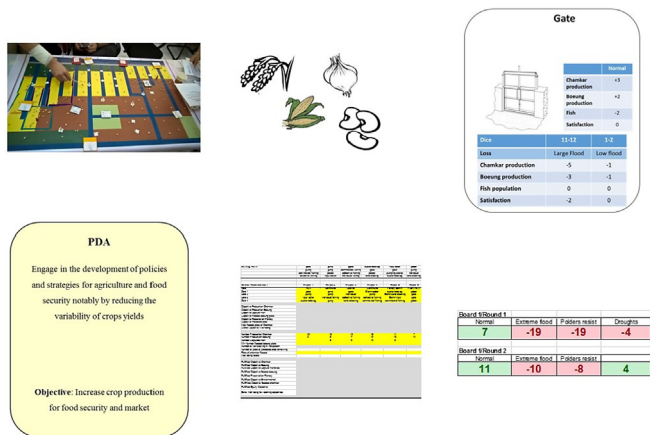


Fig. 3. Examples of a 'board', crop 'vignettes', 'action-card', 'role card', working excel computation sheet, and 'synthesized results' (left to right, top to bottom).

aged the infrastructure, the additional crops and investment would also be destroyed. Hence, minus 5 units. Again, this was not based on (non-existing) 'hard' data but on estimates of approximate consequences. After vignettes and action cards were placed on the board, floods or droughts were simulated by rolling a 12-sided dice, high numbers representing extreme floods and low numbers droughts. Once again, these probabilities were not based on hydrological modeling but rather on our 'sense' that the thresholds we used could generate a diversity of situations that would be interesting to explore collectively.

As this suggests, the game calibrations were quite 'loose.' But they were not 'neutral.' Since a major reason for playing the games was to enable collective speculation about possible landscape transformations in counter-point to hard infrastructure solutions, they pushed in that direction. In the case of extreme flood events, for example, players who had invested in dikes and sluice gates would suffer relatively higher losses than those who had opted for training courses or support for collective organization. The point was not to force players to choose those options but to make them appear somewhat more *viable* in a context where development is usually associated with the construction of cement structures.

The next section examines how constraints were negotiated at the level of board design. Rather than a process of depoliticization via technical simplification, this took the form of a series of disagreements about *how and in which form* to inscribe politics on the board. We then describe the entry of some unsurprising social and gender-related games of power. However, *alongside* these games of power, we glimpse other potentials. With the aim to turn serious games into technologies of humility it is crucial to learn from such glimpses. They are signs of the conditions under which participatory formats might do "a little more than oppress the user" (Gomart, 2002: 517).

5. Designing the board

Let us examine the considerations that went into designing the game board with the WAT4CAM technical experts. It began with their insistence that the board had to *properly represent* 'their' project area (e.g. the *preks* they planned to rehabilitate). Otherwise, the experts argued, the game would not be serious.

This ran counter to the central assumptions of Companion Modeling in two ways. First, it would minimize the distance between game and reality and thus make it easier for real power relations to take over the games. Second, the familiar looking board would make it harder to imagine radical alternatives. Since we precisely wanted to explore alternative forms of landscape transformation there was a problem.

However, the demand for geographical realism could not be ignored. It was, after all, *us* who had pushed the skeptical technical teams to join us as designers. It was also *us* who hoped that the game would bring them face to face with ideas sufficiently intriguing to bring into their plans for *prek* rehabilitation. Thus, we had to come up with a design that was 'real' enough for our partners to accept as 'serious.' But it still also had to support our own agenda.

We tried to solve this issue in two ways. The board had to resemble the project area 'enough' but what that meant was open to interpretation. As a result of previous interactions, we had made some inroads with the argument that considering several adjacent *preks together* made better sense than a focus on single channels: the WAT4CAM technical teams had begun to organize work around *clusters of preks*. Accordingly, we suggested that the board could represent the first cluster proposed for rehabilitation (see Fig. 1). But we insisted that the board should encompass the whole *boeing* in which this cluster 'terminated'.

The technical experts knew quite well that this made hydrological and agricultural sense.⁹ Even so, it spelled trouble since only part of the *boeung* fell within their official 'project area,' which somewhat arbitrarily defined an old Khmer rouge canal running through the middle of it as its western limit. It would be difficult to make interventions outside the formal 'project area' but also to dismiss requests made during a participatory workshop organized in relation to the project. Ironically, this meant that geographical realism was a generous constraint for the technical teams but only halfway through the *boeung* after which it immediately became ungenerous. In contrast, including the whole *boeung* was important to us. It highlighted the legitimacy of farmers' concerns beyond the confines of the project – turning its full inclusion into a generous constraint.

These negotiations exhibit tensions between our research agenda and the views of AFD's technical teams. They also challenge the conventional wisdom that "rendering technical" and 'simplifying' is always depoliticizing. Because the disagreements had nothing to do with being for or against constraints in general. They were not about *whether or not* politics should be embedded in the board design but about *the particular form* of politics that different kinds of constraints would inscribe in game sessions. The eventual design was a compromise that tried to maintain relative generosity despite significant disagreements. The board was connected to a specific project area—the first cluster of *preks* considered for rehabilitation—but it *also* connected *preks* considered for rehabilitation to previously rehabilitated ones and it covered the entire *boeung*.

The fact that a particular 'politics' had been inscribed on the board did not mean that extant development priorities now silently dominated the whole scene. To the contrary, the relative importance of the board, the rules, and the calibrations all varied with other constraints introduced by participants in the course of playing. These local, emerging constraints were often so forceful that we had difficulties maintaining our focus on alternatives for landscape transformation.

6. Games of power

As a consequence of the permeable boundary between game sessions and real world, all kinds of problems, conflicts and grudges seeped into the games.¹⁰ Tackling them required an enormous amount of time and energy.

If we nevertheless keep the discussion brief, it is because power relations in development contexts are so well studied (e.g. Cornwall, 2013; Lund & Saito-Jensen, 2013; Ribot et al., 2006) that their primary relevance here is as a *counter-point*. They exhibit what we constantly struggled against to provide the games with a chance to be something a bit more generous as well.

The following provides an example:¹¹

Participants sit by a board designed by a group of farmers. The discussion focuses on which canals should be excavated in the *boeung*. I ask participants to move tokens on the board to reflect

the discussions so it is easier to keep track of things. Behind a village chief, three women are quietly discussing. In the previous session, they had been quite vocal about which canals they wanted excavated, yet they had put tokens on the board only reluctantly, and with direct encouragement. The male participants on the other side of the table showed no such compunctions. They quickly placed their tokens and cards to show what they wanted.

Concerned that the women's viewpoint is about to be sidelined again, I discreetly pass a token and nod towards the table. Nobody moves. Uncertain, I ask the facilitator to make everybody show their remaining tokens. Slowly, the women raise their hands. But as I invite them to step forward, they gently touch the shoulder of the chief sitting in front, and pass their tokens on (Observation notes, game session, August 2020, JPV)

We are confronted with social constraints relating to identities, gender, and power, loaded into the game by the players themselves. The image of the women passing the token to the village chief makes clear that defining something as a game is insufficient to create a space for open-ended speculation. Evidently, the critiques of participation are not irrelevant.

They are also pertinent with reference to the following, where a man refrains from acting within the game because the 'same act' would cause conflict in reality:

JPV: Do you want to put a gate there?

Participant: Yes, that is what we are discussing

JPV: Here [passing a token], you can put it if you want

Participant: No... It is ok

JPV: I don't understand, if you think it is a good idea, why don't you put it?

Participant: Before we put it, we need to ask [points to a man sitting in the other group]

JPV: Ah ok, why don't you go there and ask him then

Participant No... It is ok

(Dialogue with farmer, game session, May 2019)

This session featured two groups discussing what to do around a board they had designed to represent the same *prek*. One group wanted to build a sluice gate but decided not to do it because they knew that the village chief, who was in the other group, would object.¹²

Three women defer to the village chief. A man declines to act in a way that would mobilize a real conflict. Both examples show players busily closing the very gap between game and reality, which ComMod argues is prerequisite for keeping power relations at bay.

We are thus faced with a question. What happens when the two core methodological tenets—a healthy distance between game and reality must be maintained and players should be allowed to modify the design of the game—conflict? Clearly, the invitation to redesign the game can also work against aspirations to facilitate collective explorations.

The following section starts from this tension. It shows that although 'distance' does not really prevent power relations from influencing the games, the critiques of participation are still only partially vindicated. Because as participants kept tinkering with constraints, glimpses of other landscapes and relational possibilities also emerged.

¹² Discussions during the workshop revealed that the village chief ran a small pumping station and sold water to farmers. Building a sluice gate entailed—at least theoretically—year-round water availability in the *prek*, which might ruin this business.

⁹ Hydrologically, the *preks* are interconnected 'through' the *boeungs*, which are thus crucial for water control and management. In agricultural terms, it is often the same farmers who cultivate the *boeung* and *chamkar*; they adopt complementary farming strategies for these different types of land.

¹⁰ Permeability is recognized by both critics of participation and participatory modelers. For critics, the boundary is so permeable as to be a fiction, which is why power relations always contaminate participatory formats. For the modelers, the point of distance is to make the boundary temporarily less permeable to keep those power relations out. In fact, distance does not suffice for this job. As we discuss below, what nevertheless makes it possible for games to be something more than mere games of power is tinkering with patterns of constraints.

¹¹ All descriptions are based on short-hand observation notes and dialogue excerpts (some translated 'live' from Khmer to English by a Cambodian facilitator). They have been grammatically corrected.

7. Mosaic glimpses

To safeguard the methodologically required ‘distance’ between games and reality, by far the majority of games were played on boards that *randomly* assembled land types¹³ and connections between rivers, *preks*, and canals. However, this perplexed many players, who failed to see the relation between our ‘serious questions’ and generic boards that didn’t resemble the landscapes they knew. Similar to the technical experts, though for different reasons, most local people would *also* rather play on boards they could associate with specific places. Which, again, is precisely what we wanted to avoid.

The following exchange followed the presentation of one ‘random’ board prepared for a session.

Official: What places does the board show?

JPV: It’s pretty much up to you.

Official: We need to know, if you are asking what we think should be done.

JPV: We can say that this [pointing to a blue area on the side of the board] is the Mekong ... or the Bassac, whichever you want.

Official: It is the Mekong because... [Points to a light green patch on the board]

JPV: [All seem to agree] Let’s say it is the Mekong then.

Official: Ok, we can go ahead now.

(Dialogue with official, game session, May 2019)

The official immediately wants to connect the board to a known place. In fact, this was easily done, since it merely required the players to agree that the board showed the right bank of the Mekong. As the game continued on that basis, the distance between game and reality did not really *collapse*—after all the physical features of the board did not change—but it was also not *maintained*, since everybody now associated the game with a specific area of the mosaic landscape.

However, in this case, rather than a predictable ‘game of power’ the result was resonance between researchers and players at the level of game *orientation*. The spontaneous decision to have the board represent a good chunk of the mosaic landscape created speculative leeway. In contrast with monotone technical discussions centering on the depth of excavation of a specific *prek*, or whether or not to build a pumping station or a sluice gate (Venot and Jensen, 2021), quite varied scenarios began to emerge. Some focused on intensifying vegetable and fruit produce in the *chamkar* and others on protecting *boeungs* from extreme flooding. Some concentrated water infrastructures in specific ‘hot-spots,’ while others distributed structures over the entire landscape. There were mosaic glimpses of other landscapes.

Meanwhile, other sessions exhibited permeable boundaries between types of players, or between players and researchers.

After forming groups, farmers gather around a board in the pagoda. The facilitator begins to explain what the board shows, assigning names to the *preks* and canals. After a moment, farmers start discussing, asking questions, and adding pieces of wood on the board. They place different market places and a pagoda. After more discussion, they add blue tiles for a missing canal. In the afternoon, officials are asked to look at the board designed by farmers and vice versa. Looking at the number of canals shown in the *boeung* on the ‘farmer board’, a commune chief is surprised to count four. He asserts there should only be three canals [as in the board we had pre-designed, which was modified by the farmers], and begins to remove the blue tiles. But a village chief stops him and confirms: “there is a canal here” and, pointing to another area of the board adds “and here

too.” After discussing, they further modify our board design by shifting around yet another canal. (Observation notes, game session, August 2020, JPV).

Here we see different player orientations to the ‘power relations’ inscribed in the game. Officials did not think to question the board, which had been designed in accordance with our ‘expert knowledge.’ They took it for granted and simply played *on* it. However, farmers *redesigned the board* by adding a missing canal to fix our mistake. Noticing the discrepancy between the boards, the commune chief was thus startled. But with further confirmation that the added canal did indeed exist, came an awareness that our ‘expert’ board might have other flaws – which led to curiosity, dialogue, and further modifications.

A final excerpt illustrates provisional changes in power relations. Here, the players improvised a consensual result in direct contravention of game rules.

The two groups (farmers and officials) were asked to separately negotiate a set of interventions on their boards. Quickly, officials from group 1 went to see the farmers in group 2, asking about what they had done on the board, then returning to replicate it on theirs. Farmers went in the other direction and further modified the position of the tokens. We let it slide... (Observation notes, game session, August 2020, JPV)

This session had, in fact, begun with quite stern rules *against* interactions between the two groups. They were simply ignored. As people moved back and forth and communicated, the boards started to look more and more similar. For example, small, identical bridges first proposed by farmers appeared in the same area on both boards. This improvised harmony seemed to strengthen the proposal: the attendant WAT4CAM project engineer took copious notes and asked many follow-up questions.

From these ‘glimpses’ can be drawn both ‘critical’ and ‘constructive’ conclusions. We observe again that the simplifications and forms of “rendering technical” specific to the games cannot be reduced to ‘repression’ or ‘depoliticization.’ Instead, tinkering to keep the constraints flexible in different situations supported problematic (imperfect and in friction) articulations of different forms of infrastructural politics in relation to the *preks*. That tinkering was continuously required to keep the games on track makes clear that ‘distance’ is hardly a methodological solvent for issues of power. Conversely, the fact that relations between different participants, and researchers did transform in the course of playing also indicates that boundaries *can* be kept relatively permeable by attentive experimentation with generous constraints.

8. Calibrating participation

We have mainly concentrated on the game sessions. This surface level focus has facilitated examination of the interplay between many kinds of constraints. But it leaves other aspects untouched. Central are the calibrations, which, because they are at the technical heart of the games, are prime suspects for *secretly* depoliticizing the issues. For the same reason, they were rarely subject to explicit discussion in game sessions although we always mentioned them (Fig. 3).

However, calibrations were always discussed backstage, during the preparatory workshops. Here, for example, JPV has asked whether our partners understood the game ‘mechanics’:

Vira Oum: What I still do not understand is the calibration – How does it work? Why did you choose the numbers you chose?

JPV: The number are not what is important. It’s the overall logic that matters.

¹³ Defined in terms of likelihood of flooding and types of agriculture.

Kong Sinh: Me too, I still do not get it, what do the numbers represent?

JPV: The numbers do not matter. We could have chosen 2, 4, 6, it does not matter. What matters is that they make sense in relation to each other and that it is easy enough to manipulate in the game and does not take too much time.

Vira Oum: Mhhhh. . .

(Preparatory workshop, May 2019)

As we see it, this perplexity indexes two related issues. First, the seriousness of the games is once again connected to the accuracy or 'reality' of numbers. Second, more subtly, but more fundamentally, our admission that the games were not based on 'hard facts' also ran counter to the conventions of development workshops, where facilitators and experts are supposed to convey authoritative knowledge to participants imagined to lack it.¹⁴ In light of this expectation, our vague designs and qualitative calibrations often confounded our partners from ISC and RUA. When they got their own opportunity to design a game, the approach they took was strikingly different.

After years of working together, it was no longer a surprise that we had rather different understandings of the serious games. However, the magnitude of those differences only crystallized towards the end of our first project. Around this time, our primary concern was to ensure that our partners could facilitate participatory game sessions on their own and they piloted the last preparatory workshop we held. Not limited by our focus on water and infrastructure, the next game would center on safe agricultural product value chains, a topic they had been interested in since the beginning of our collaboration.

Our partners completely dissolved the game design. In this new game, there were no *preks*, land-types, floods and droughts, sluice gates, or even a board. Instead, each player sat in front of a stack of wooden tiles, which they could assemble to represent individual farms. They placed crop vignettes on tiles, purchased seeds and inputs, and sold products with numbered tokens and bills representing income.¹⁵ As the board decomposed into a set of movable elements, all constraints seemed to vanish. The game was now *much more generic* than we had imagined, but in a totally different way.

And yet, behind the exploded game surface, our partners introduced very rigid calibration measures. They wanted to account for the exact price of a bag of pesticides, the correct market value of fruits and vegetables, and precisely how many extra crops a farmer would gain per added bag of inputs. The demand for realism was moving from the board surface into the black box of calibrations.

The official rationale was to make the game more easily relatable to farmers. But when we quizzed Vira and Kong about the hours they spent concocting numbers we were told quite a different story. Realism, they now insisted, was crucial to *convince* farmers "that safe agricultural production is better than current practices." The farmers had to *be made to understand* the importance of "coordinating to meet the demand of potential buyers." As sessions were redefined as behavioral scripts and guidelines for the players,¹⁶ the game itself changed into a tool for *raising*

¹⁴ These conventions may also explain why calibrations were hardly discussed during game sessions.

¹⁵ This game was played with farmers in February and March 2020 without our involvement (Figure 2).

¹⁶ The point, again, is not that only *these* calibrations constrained the players. It is that the manner of constraining differed. While our calibrations made options other than hard infrastructure slightly more viable in the face of extreme events, the new game had a single winning scenario premised on avoidance of chemical inputs. At the same time, however, our partners' decomposition of the game also *created generative openings*. For example, it made us realize the boards could be redesigned on the spot. This came in handy when we had to make the board represent the WAT4CAM project area 'realistically.'

awareness about topics and solutions defined in advance by the experts – not the foreign research experts, mind you, or even AFD's technical experts, but Cambodian NGO experts and university staff.

From a broader perspective, we would suggest that these divergent strategies of calibration relate to different orientations to the making of development knowledge in general. On one side is the hubristic idea that for games to be serious, the major empirical components (and preferred outcomes) must be known in advance. In our opinion, this is neither very generous nor serious.

In contrast, taking uncertainty with respect to the system, its relations, and its possibilities seriously pulls serious games in the direction of hybrid forums that facilitate open-ended explorations. They are provided with a chance to become technologies of humility. We have thus come full circle.

9. Conclusion

This paper has used a series of serious games played in Kandal, Cambodia as an entry point to reexamine relations between development projects, participatory formats, and sustainable futures. It is undeniable that serious games simplify complex problems and render them technical. But, entering the black-box, we have shown that the results are not reducible to a matter of domination. What is required for the games to do 'a little more' than repress the players is keeping a range of socio-technical patterns of constraints relatively *generous*.

In Kandal's mosaic landscape, the 'little more' we aimed for related to two issues. In contrast with *prek* rehabilitation that focused on intensifying agriculture by excavating channels and building water control infrastructure, we were inspired by recent alternatives to delta management centering on 'nature-based solutions.' We also wanted to learn from a variety of voices—not just experts and policy-makers but also farmers and fishermen—what they thought mattered in and about the landscape. Moreover, as time passed, we began to wonder how those voices might be heard by the technical teams tasked with the next rehabilitation project. Thus, we came to envision serious games as hybrid forums for the collective exploration of, and speculation about, alternative landscape scenarios that might sustain a variety of more-than-human worlds.

As discussed, this involved many forms of "rendering technical" and numerous constraints introduced by the researchers and their partners, from calibrations and board design to rules for player interactions, and self-imposed player sanctions. None of those constraints were neutral. As we have shown, however, they are also not well captured by general rubrics like repression or depoliticization. To understand the divergent politics of participatory formats like serious games, it is crucial to zoom in on the *specificity* of constraints.

Constraints can be more or less supple and flexible, or rigid and fixed, in different aspects. For example, Companion Modeling promotes 'distance' as a generous constraint that is meant to support collective experimentation by reducing the expression of real power relations in the games. But distance cannot really keep such relations away, and both technical experts and local villagers tended to view games that facilitated actionable propositions as more generous.

What can prevent games from becoming *mere* contests of power is ongoing tinkering to keep the patterns of constraints generous and the boundaries between virtual and real worlds, insiders and outsiders, and present and futures *relatively permeable*.

In our view, the most generous achievement of the games was broadening the exploration of sustainable futures to the level of the mosaic landscape. Most scenarios retained a focus on infrastructure development but they were strikingly heterogeneous

compared with monotonous debates about excavation options for single *preks*.

Although the new technical teams continue to harbor doubts about ‘seriousness,’ they now intend to involve local actors in elaborating their ‘master plan’ for future *prek* rehabilitation. The small bridges spontaneously emerging on separate game boards have been translated into engineering blueprints. And we have learned from our partners at RUA and ISC that speculative environmental scenarios need to go beyond our obsession with water issues. These are all mosaic glimpses of how participatory formats can do a little more than oppress the user.

They can operate as experimental systems for collective exploration, which are serious to the extent that they work like technologies of humility rather than hubris.

Humility must be understood in a double sense. It acknowledges uncertainty and a need for collective learning premised on appreciation of heterogeneous voices. In this sense, it involves an effort to push away from the embedded epistemic hierarchies of development. As hybrid forums, serious games support efforts to ‘do difference together’ (Verran & Christie, 2011) in explorations of more-than-human worlds and divergent practical ontologies. At best, they can begin to redirect active–passive relations between development ‘experts’ and ‘recipients’ towards more reciprocal constructions.

At the same time, humility entails awareness that participatory games rarely have world-shattering consequences. Most things remain in place, and many of them—from the practices of French development funders and the orientations of water engineers to Cambodian political hierarchies and embedded gender inequalities—are very hard to change however much we would like to. From this angle, humility evokes a pragmatics of aspiration in which *smaller changes count for something too*. The bridges, for example, are a small success for people living along these *preks*. But they are also devices that bridge—or scale—between that achievement and our landscape approach, which they make appear slightly more viable.

In turn, we have tried to make the notion that more-than-human mosaic landscapes can be supported by experimenting with serious games as technologies of humility slightly more viable in these pages. Rather than merely depoliticizing, experimental participatory formats can help articulate the multiple practical ontologies involved in *prek* rehabilitation. Learning from this multiplicity matters for moving towards sustainable forms of living in Kandal and elsewhere.

CRediT authorship contribution statement

Jean-Philippe Venot: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Casper Bruun Jensen:** Conceptualization, Writing – original draft, Writing – review & editing. **Etienne Delay:** Methodology, Investigation, Writing – original draft. **William’s Daré:** Methodology, Investigation, Writing – original draft.

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.

Acknowledgments

This research has been conducted in the framework of the *Deltas’ Dealings with Uncertainty* (DoUBT) and COSTEA projects. Financial support from the French National Agency for Research (ANR) and

the Japan Society for the Promotion of Science (JPSP) in the context of the Open Research Area (ORA) for the Social Sciences program, and from the French Agency of Development (AFD) through the *Association Française de l’Eau, l’Irrigation et le Drainage* (AFEID) is duly acknowledged. The authors would like to thank their colleagues from the Irrigation Service Center and the Royal University of Agriculture as well as all participants who contributed to designing and played the *serious games* described.

References

- Barnaud, C., Trébuil, G., Promburom, P., & Bousquet, F. (2008). La modélisation d’accompagnement pour une gestion concertée des ressources renouvelables en Thaïlande. *Economie Rurale*, 303–304–305, 39–59.
- Barnaud, C., & Van Paassen, A. (2013). Equity, power games, and legitimacy: Dilemmas of participatory natural resource management. *Ecology and Society*, 18(2), 21. <https://doi.org/10.5751/ES-05459-180221>.
- Barreteau, O., Abrami, G., Bonte, B., Bousquet, F., & Mathevet, R. (2021). Serious Games. In R. Biggs, A. de Vos, R. Preiser, H. Clements, K. Maciejewski, & M. Schlüter (Eds.), *The Routledge handbook of research methods for social- ecological systems* (pp. 176–188). London & New York: Routledge.
- Barreteau, O., Antona, M., d’Aquino, P., Aubert, S., Boissau, S., Bousquet, F., Daré, W., Etienne, M., Le Page, C., Mathevet, R., Trébuil, G., & Weber, J. (2003). Our companion modelling approach. *Journal of Artificial Societies and Social Simulation*, 6(1).
- Barreteau, O., Bousquet, F., Etienne, M., Souchère, V., & D’Aquino, P. (2014). Companion modelling: A method of adaptive and participatory research. In M. Etienne (Ed.), *Companion Modelling: A participatory approach to support sustainable development* (pp. 13–40). Dordrecht: Springer.
- Bateson, G. (1987). *Steps to an ecology of mind: Collected essays in anthropology, psychiatry, evolution and epistemology*. Northvale, NJ & London: Jason Aronson Inc..
- Bécu, N., Neef, A., Schreinemachers, P., & Sangkapitux, C. (2008). Participatory computer simulation to support collective decision-making: Potential and limits of stakeholder involvement. *Land Use Policy*, 25(4), 498–509. <https://doi.org/10.1016/j.landusepol.2007.11.002>.
- Callon, M., Lascoumes, P., & Barthe, Y. (2001). *Acting in an uncertain world: An essay on technical democracy*. Cambridge, MA & London: MIT Press.
- Cooke, B., & Kothari, U. (2001). *Participation: The new tyranny?* London: Zed.
- Cornwall, A. (2013). Whose voices? Whose choices? Reflections on gender and participatory development. *World Development*, 31(8), 1325–1342.
- Daré, W., & Barreteau, O. (2003). A role-playing game in irrigated system negotiation: Between play and reality. *Journal of Artificial Societies and Social Simulation*, 6(3).
- Etienne, M. (2014). (Ed.). *Companion Modelling: A participatory approach to support sustainable development*. Dordrecht: Springer, Versailles: QUAE.
- Ferguson, J. (1990). *The Anti-politics machine: “Development”, depoliticization, and bureaucratic power in Lesotho*. Cambridge: Cambridge University Press.
- Feyerabend, P. (1993). *Against method*. London: Verso.
- Foucault, M. (1973). *The birth of the clinic: An archaeology of medical perception*. New York: Pantheon.
- Foucault, M. (1977). *Discipline and punish: The birth of the prison*. New York: Pantheon.
- Geertz, C. (2005). Deep play: Notes on the Balinese cockfight. *Daedalus*, 134(4), 56–86.
- Gomart, E. (2002). Towards generous constraint: Freedom and coercion in a French addiction treatment. *Sociology of Health and Illness*, 24(5), 517–549.
- Gomart, E. (2004). Surprised by methadone: In praise of drug substitution treatment in a French clinic. *Body & Society*, 10(2–3), 85–110.
- Green, M. (2010). Making development agents: Participation as a boundary object in international development. *Journal of Development Studies*, 46(7), 1240–1263.
- Halbe, J., Pahl-Wostl, C., & Adamowski, J. (2018). A methodological framework to support the initiation, design and institutionalization of participatory modeling processes in water resources management. *Journal of Hydrology*, 556, 701–716. <https://doi.org/10.1016/j.jhydrol.2017.09.024>.
- Hickey, S. and Mohan, G. (2004). Towards participation as transformation: Critical themes and challenges. In S. Hickey and G. Mohan (Eds.) *Participation: From tyranny to transformation? Exploring new approaches to participation in development*. London & New York: Zed, pp. 3–25.
- Jasanoff, S. (2004). Technologies of humility: Citizen participation in governing science. *Minerva*, 41, 223–244.
- Jensen, C. B. (2005). Citizen projects and consensus-building at the Danish board of technology: On experiments in democracy. *Acta Sociologica*, 48(3), 221–235.
- Jensen, C. B., & Winthereik, BR (2013). *Monitoring movements in development aid: Recursive partnerships and infrastructures*. Cambridge, MA & London: MIT Press.
- JICA (Japanese International Cooperation Agency). (1998). *The agricultural development study of the Mekong flooded area in Cambodia-Final report*. Sanyu Consultant.
- Jonsson, A., Andersson, L., Alkan-Olsson, J., & Arheimer, B. (2007). How participatory can participatory modeling be? Degrees of influence of stakeholder and expert perspectives in six dimensions of participatory modeling. *Water Science and Technology*, 56(1), 207–214. <https://doi.org/10.2166/wst.2007.453>.

- Jordan, R., Gray, S., Zellner, M., Glynn, P. D., Voinov, A., Hedelin, B., ... Prell, C. (2018). Twelve Questions for the Participatory Modeling Community. *Earth's Future*, 6(8), 1046–1057. <https://doi.org/10.1029/2018EF000841>.
- Li, T. M. (2007). *The will to improve: Governmentality, development and the practice of politics*. Durham, NC & London: Duke University Press.
- Lund, J. F., & Saito-Jensen, M. (2013). Revisiting the issue of elite capture of participatory initiatives. *World Development*, 46(2013), 104–112.
- Mathevet, R., Antona, M., Barnaud, C., Fourage, C., Trébuil, G., & Aubert, S. (2014). Contexts and dependencies in the commod processes. In M. Etienne (Ed.), *Companion Modelling: A participatory approach to support sustainable development* (pp. 103–125). Dordrecht: Springer.
- Patamadit, I., & Bousquet, F. (2005). The Thai traditional learning process in folk culture : Implications for the companion modelling approach. In F. Bousquet, G. Trébuil, & B. Hardy (Eds.), *Companion Modeling and multi-agent systems for integrated natural resource management in Asia* (pp. 295–308). IRR: Manila, The Philippines.
- Ribot, J. C., Agrawal, A., & Larson, A. M. (2006). Recentralizing while decentralizing: How national governments reappropriate forest resources. *World Development*, 34(11), 1864–1886.
- Star, S. L., & Griesemer, J. R. (1989). Institutional ecology. "Translations" and Boundary Objects: Amateurs and professionals in Berkeley's museum of vertebrate zoology. *Social Studies of Science*, 19(3), 387–420.
- Strathern, M. (1996). Cutting the network. *Journal of the Royal Anthropological Institute*, 2(3), 517–535.
- Venot, J. P., & Fontenelle, JP (2016). *Politique de l'irrigation au Cambodge: Articulations et enjeux des interventions de l'AFD*. Paris: COSTEA.
- Venot, J. P., & Jensen, CB (2021). A multiplicity of prek(s): Enacting a socio-natural mosaic in the Cambodian upper Mekong delta. *Environment and Planning E: Nature and Space*. <https://doi.org/10.1177/25148486211026835>.
- Verran, H., & Christie, M. (2011). Doing difference together: Towards a dialogue with aboriginal knowledge authorities through an Australian comparative empirical philosophical inquiry. *Culture and Dialogue*, 1(2), 21–36.
- Voinov, A., & Bousquet, F. (2010). Modeling with stakeholders. *Environmental Modelling & Software*, 25(11), 1268–1281.
- Voinov, A., Kolagani, M., McCall, M. K., Glynn, P. D., Kragt, M. E., Ostermann, F. O., Pierce, S. A., & Ramu, P. (2016). Modeling with stakeholders – Next generation. *Environmental Modelling & Software*, 77(2016), 196–220.
- Wesselink, A., Warner, J., Abu Syed, M. d., Chan, F., Tran, D. D., Huthoff, F., Le Thuy, N., Pinter, N., van Staveren, M., Wester, P., & Zegwaard, A. (2015). Trends in flood risk management in deltas around the world: Are we going 'soft'? *International Journal of Water Governance*, 3(4), 25–46.
- Wesselow, M., & Stoll-Kleeman, S. (2018). Role-playing games in natural resource management and research: Lessons learned from theory and practice. *The Geographical Journal*, 184(3), 298–309.
- WWAP (United Nations World Water Assessment Programme)/UN-Water. (2018). *The United Nations World Water Development Report (2018): Nature-Based Solutions for Water*. Paris: UNESCO.
- Yarrow, T., & Venkatesan, S. (Eds.). (2012). *Differentiating development: Beyond an anthropology of critique*. Cambridge: Berghahn.