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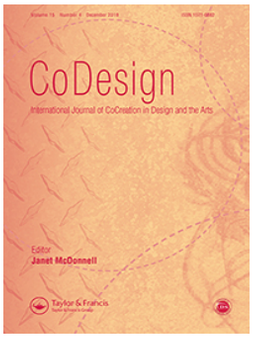

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Participatory game prototyping – balancing domain content and playability in a serious game design for the energy transition

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ABSTRACT

Game design mostly engages future players as users and testers, whereas in the field of serious game design, approaches involving players more substantially are slowly emerging. This paper documents the participatory prototyping process of Energy Safari, a serious game for the energy transition in the Province of Groningen, and reports on the differences of the contributions made to the game development by separate groups of stakeholders. Each group contributed the most to the game elements that are most relevant to their interests. Overall, this study points to the potential of participatory game prototyping as a method to develop serious games that are balanced both in terms of domain content and playability, are meaningful for future players, and well embedded in the local context.

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Serious games; serious game design; participatory game prototyping; participatory design; co-design; energy transition

1. Introduction

The last 40 years have seen a rise in the engagement of end users in design processes in many fields of design, such as urban planning (Maier 2001; Lane 2005), product and service design (Kankainen et al. 2012; Bjarki Björgvinsson 2008), and game design (Khaled and Vasalou 2014; Lange-Nielsen et al. 2012). Participatory design has been positively associated with increasing public engagement in research, contributing to learning (e.g. Conole et al. 2010; Björgvinsson and Erling 2008), ensuring that products, technologies and plans are better aligned to people's needs and more widely accepted by their future users, and with counterbalancing designer subjectivity (e.g. Burby 2003; Schuler and Namioka 1993). Participatory tools and techniques have a long-standing history within design studies and practice. 'Design Games' in particular (Brandt, Messeter, and Binder 2008; Brandt 2011; Habraken and Gross 1987; Johansson and Linde 2005; Vaajakallio and Mattelmäki 2014) are appreciated for their capacity to playfully evoke focussed discussions and support participants in sharing their experiences and dreams (Brandt, Binder, and Sanders 2013). From a game design perspective, however, games are more narrowly defined: they are structured activities during which players overcome obstacles imposed by game rules while pursuing a predefined goal

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(e.g. Huizinga 1955; Parlett 1999; Juul 2011). As such, there are major differences in the understanding of games between the fields of participatory design (games that facilitate design processes) and game design (games as end products). Additionally, despite following iterative approaches, most game design models are rarely participatory. In this study, a participatory game design process is analysed, which uses participatory game prototyping as a method to create a serious game prototype, called 'Energy Safari'.

'Energy Safari' is a serious game addressing the Energy Transition in the Dutch province of Groningen. The EU climate and energy targets aim at a 20% share of renewables in the EU energy mix by 2020 (CEC 2010). In the Dutch context, that means a necessary increase from a 5% to a 16% share of renewables by 2023 (SER 2013a). The province of Groningen is a key arena where the energy transition takes place (De Boer and Zuidema 2016). Rich in natural gas, the region has long been considered the 'Dutch Energy Valley'. The gas production is slowly depleting, but meanwhile it has caused different occurrences, such as earthquakes leading to serious property damages, decreased liveability, and social controversies about the future of the region. Transitioning to renewables, however, is not a straightforward trajectory: energy production requires extensive land-use with high landscape consumption and visual disturbance (e.g. Pasqualetti 2012; Stremke and Dobbelsteen 2010). Furthermore, it can create externalities such as noise (wind turbines) and odour pollution (bio-digesters). Hence, despite their increasing popularity, renewables also trigger considerable societal debate and social resistance (e.g. Cass, Walker, and Devine-Wright 2010; Wüstenhagen, Wolsink, and Bürer 2007). Next to large-scale energy production, individual practices such as energy saving or small-scale energy initiatives also contribute to the energy transition. A broad variety of stakeholders, such as individuals, local energy initiatives, and representatives of public administration, play an important role in these processes. Consequently, their perceptions, interests and conceptual ideas mould the spatial, institutional and social context where these practices can unfold.

Translating complex real-world issues, as the energy transition, into the context of serious games is a challenging task. While conventional game design mainly involves game designers alone, inter- and transdisciplinary approaches such as participatory game design methods are increasingly adopted, particularly in the field of serious game design (e.g. Abeele 2012; Dörner et al. 2016; Khaled and Vasalou 2014; Spinuzzi 2005). The broad involvement of different stakeholders is expected to enrich the domain content of the game, and respond to the challenge of combining learning, literacy and game design skills in the same process (Khaled and Vasalou 2014).

Thus, the research question of this paper examines the value of incorporating separate actor groups' contributions on balancing domain knowledge and playability in participatory game design processes. The question is targeted by analysing the participatory prototyping process of the serious game 'Energy Safari'; specifically examining the capacity of different stakeholder groups to develop game elements contributing to this balance in three different ways: (1) to define and improve the rule set, (2) to test and refine the game hardware, and (3) to embed the game in its regional context by ensuring that it captures existing perceptions, goals and interests of relevant stakeholders.

The following section introduces the academic debate on participatory approaches with a focus on serious games. The setup of the co-design process, and the data

collection and analysis are explained in the third section. The fourth section explains the game elements developed through the participatory prototyping process. In the final part, we conclude that adopting a participatory game prototyping process can lead to a balanced game in terms of domain content and playability, particularly when treating stakeholders not as a homogeneous group of end users, but as separate sub-groups with differing and sometimes diverging interests. This however, requires that the task of balancing the game is taken up by the design team, because the participating groups of stakeholders tend to contribute game elements that are most relevant to their interests. Additionally, we argue that participating in the prototyping process creates a sense of ownership among the involved stakeholders and supports the rooting of the game in the local context.

2. Participatory prototyping in game design

According to Adams and Dormans (2012) game design is an iterative process that starts with the designer's intention and the outlining of the game concept, is followed by the elaboration of this concept into the specifics of the game and the design of the particular mechanics that constitute the game, and closes with fine tuning and bug fixing. With some exceptions of serious games (e.g. Khaled and Vasalou 2014; Lange-Nielsen et al. 2012), game design approaches mostly engage players only for game testing. Adopting a stronger involvement of players throughout the game design process could allow game designers to learn from players' input and enrich the games on several levels (Winn 2009).

2.1 *Engaging stakeholders in serious game design*

Participatory and co-design approaches are slowly emerging in the field of serious game design. Serious game design is a relatively new discipline where standard design frameworks and practices are still under development (Winn 2009; Mildner and Mueller 2016). Involving different stakeholders in co-design activities is considered beneficial to processes such as ideation, exploration and learning, enhanced communication, and lowering game designers' biases (see Magnusson 2009; Muller 2003; Schuler and Namioka 1993; Vines et al. 2013). Stakeholders bring their real-world perceptions, ambitions and interests to the game (De Caluwe, Geurts, and Kleinlugtenbelt 2012), which may differ from the game designers' intentions, content knowledge, and expectations. Thus, participatory approaches might lower the risk of serious games failing due to blind spots and misinterpretations of domain content by the game designers. Mildner and Mueller (2016) explain four common ways to involve stakeholders in game design processes: (1) as users (how they engage with the game), (2) as testers (testing playable prototypes), (3) as informants (consulting the design team) and (4) as design partners fully incorporated in a co-design process. Involving stakeholders as design partners describes a design strategy in which professional designers and stakeholders form partnerships of equal rights and responsibilities for the design and decision-making. Hence, stakeholders are expected to learn fundamental game design skills to engage equally with game designers in a meaningful game design process, while informant design demands fewer efforts from stakeholders (Scaife et al. 1997). As

informants, stakeholders contribute to specific questions based on their knowledge, experience, skills and perspective. Consequently, stakeholders must not learn game design to actively participate in the game-design process (De Jans et al. 2017), but game designers need to integrate the developed game components and balance the game. Most serious game design concepts do not have a clear position regarding the involvement of stakeholders in the design process and their capacity to contribute to the game design (Marfisi-Schottman, George, and Tarpin-Bernard 2010).

2.2 *Participatory prototyping*

Prototyping is an acknowledged method of participatory design, particularly for investigating real-world complex issues that demand the involvement of various stakeholders (e.g. Sanoff 2010; Snyder 2003). Prototypes are tentative and physical manifestations of ideas in different stages of development that facilitate the design process. They elicit response, stir exchange among the co-designers, are explicit and concrete enough to challenge abstract cognitive models, and give shape to future products, services or spaces (Sanders and Stappers 2014). Prototyping is valued for its capacity to evoke focused group discussions and learning, test scenarios and hypotheses, question theories, experience previously unavailable situations, or explore uncertain and speculative future scenarios (Sanders and Stappers 2014; Stappers 2013; Kirby 2010). In this article 'participatory game prototyping' is denoted as a specific application of co-design where different stakeholders and potential future players prototype game components for the serious game.

3. Research methods and experimental set-up of the participatory game prototyping

The co-design and research process followed a qualitative, research-through-design approach based on the premise that designing can produce new insights, skills and knowledge that support the understanding of wicked problems (Frayling 1993/4; Rittel 1972; Stappers 2007). The participatory game prototyping process was set-up as an iterative, incremental process of five game prototyping workshops engaging in total 25 participants.

3.1 *Set-up of the participatory game prototyping process*

The starting point of the participatory game prototyping was a basic prototype developed by the research team to a degree that the co-designers could associate with a 'game'. Each prototyping session followed a similar routine: the co-designers gathered around the initial game prototype, followed by the explanation of the intention, game goals and the basic game rules by a researcher. Consequently, the co-designers engaged with the game prototype through different activities. These activities included the adoption and debate of 'extreme' scenarios, the improvisation of new rules, and suggestions about the appearance of the game. The participatory prototyping was a non-scripted activity, following rather the concept of free play than a fixed, rule-guided design activity (Deterding et al. 2013). The free-form approach yields the advantage that

the participants decide on the focus of the prototyping session and not the script. Each prototyping session ended with a debriefing organised as a focus group discussion. The participants discussed and evaluated the session, the developed game components and how they differed from the elements developed by previous groups. After each session, the generated ideas and game mechanics were critically reviewed by the research team, and if decided to be adopted, they were translated into the prototype, using what Khaled and Vasalou (2014) address as 'transformative approach'. The updated game prototype would be played with the next group of stakeholders, iterated again, played with the next group, and so on.

3.2 *Game prototype's policy context*

Energy Safari is a six player, co-located game situated in the Province of Groningen, aiming to make players familiar with the overall policy vision for the Energy Transition in the region, introduce the variety of potential, relevant projects, and stimulate collective efficacy. The game is developed as part of a research project exploring the potential of co-located serious games for participatory planning and governance. Hence, the game's goal is to instigate different learning and capacity building processes, in the case of Groningen, on the topic revolving around the 'energy transition' and its regional manifestation and context; those processes were evaluated in a later stage of the project. The narrative of the game is derived from the local and regional policy landscape: in the Agreement on Energy for Sustainable Growth (SER 2013b) more than 40 organisations in the Netherlands (e.g. government, trade unions, environmental organisations) commit to a target of 14% of affordable, clean energy by 2020 and new employment opportunities in the energy sector (RVON 2016). The game's domain content is based on a broad policy analysis, including: Agreement on Energy for Sustainable Growth (SER 2013a), Masterplan for Energy-Neutral Groningen (Groningen 2015), Local Energy Monitor (HIER Opgewerkt 2016), Energy — Economy in 2035 (E&E Advies 2015). Additional information was obtained by eight interviews with members of local energy initiatives, organisations facilitating citizen initiatives, energy researchers, and local and regional policymakers. As the main target audience of the game is citizens unfamiliar with energy policy, entities such as these could potentially adopt the Energy Safari and use it to communicate their role and position in the Energy Transition in the region. Particularly members of the public administration, civic initiatives, and energy cooperatives have demonstrated a strong interest in testing new tools to communicate the complexities of the energy transition to a broader audience and engage more citizens in their activities.

3.3 *Participants*

Participants (n = 25) in the participatory prototyping sessions were identified to cover a range of different expertise, skills, and experiences and were invited by the research team. A selected number (n = 8) were interviewed prior to the prototyping sessions on their experiences, expectations and barriers in the facilitation of serious games (Ampatzidou et al. 2018), and all of them were invited to join the playing sessions and give feedback on the game, once a final prototype was in place. Participants formed

four distinct stakeholder groups: (1) group of game designers (2) interdisciplinary group of researchers (urban and energy planning, economic and cultural geography, sociology), (3) public administration (municipality of Groningen), (4) civic initiatives, SMEs and energy cooperatives, based in Groningen. Apart from the first group, all other participants were inexperienced in game design.

The researchers initiating and managing the game design and research process played a double role: first observing and mapping the participatory game prototyping process, and second facilitating the prototyping sessions and integrating the co-designed game elements into the prototype. During the game prototyping sessions, the tasks were divided to keep the two processes clearly separated.

3.4 *Data and analytical structure*

Data collection from the participatory game prototyping sessions was based on participant observation, note taking by one of the two researchers, and photographic documentation. After each session, the research team reviewed the notes and made a systematic organisation of the suggestions made by the co-designers using the four layers of Winn's (2009) Design, Play and Experience (DPE) framework.

The DPE framework focuses on the intended player experience, which is greatly influenced by the cognitive, social, cultural, and experiential background of the player (Winn 2009). The player's experience is further translated into 'design' and 'play' (Table 1). The three pillars of design, play, and experience are analysed through a series of layers consisting of learning (learning goals and pedagogical content), storytelling (e.g. setting, characters and narrative), gameplay (e.g. rules, mechanics and actions), and user experience (game interface). The mechanics proposed during the session were embedded in the prototype when they corresponded to either one of the layers of the DPE framework, that is when they: (1) contributed to the learning goals of the game, (2) introduced elements that made the narrative more accessible and

Table 1. The design, play, experience (DPE) framework. Redrawn by the authors from Winn (2009).

	Design (Designer)	Play	Experience (Player)
Learning	Content & Pedagogy	Teaching	Learning
Storytelling	Character, Setting & Narrative	Storytelling	Story
Gameplay	Mechanics	Dynamics	Affect
User Experience	User Interface	Interactivity	Engagement
	Technology		

compelling (3) improved the playability of the game and (4) did not create contradictory situations with other game mechanics. There are two reasons that make the DPE framework a suitable framework to structure and consequently analyse the game components created during the participatory prototyping process in this study. First, the DPE framework suggests that the game design process encompasses the full spectrum of input from both the designer and the player, and can work as a bidirectional process. Second, because the DPE framework was specifically developed to address serious game design, where establishing the learning goals and deciding on the pedagogical content of the game is defining for the whole game design process.

4. Results from the participatory game prototyping: game elements prototyped by different stakeholder groups

The final game prototype of Energy Safari includes a game board divided in hexagonal tiles of different colours, representing different types of projects that can be realised. Some areas represent special zones such as risk zones (earthquakes, flooding) and urban clusters with specialised functions. Each player needs to realise energy-related projects by networking with other players, and obtaining permits and project financing. Players also have to deal with consequences of neighbouring projects and global externalities such as political changes and environmental phenomena, while every year they are expected to pay increasing costs for their energy use. The game provides three winning conditions to be met after a fixed amount of five rounds: having the highest energy output, the highest score of community points, and the largest amount of coins left.

The prototype provided at the starting point of the participatory game prototyping sessions included an abstracted, tessellated map of the province of Groningen, project cards describing proposed projects and the conditions to realise them, coin tokens, an avatar for each player, and a dice (Figure 1). The results of the participatory prototyping process are presented according to each stakeholder's group contribution to the layers of the DPE framework (Table 2), detailing which elements they contributed to which layer of the framework.

Figure 1. Three stages of development of the game prototype. From left to right: prototype developed with the game designers group and tested with researchers, prototype developed with the policymakers group and tested with the members of energy initiatives group, final game prototype.

Table 2. Overview of each stakeholder group's contribution at each layer of the DPE framework.

	Game designers	Researchers	Policy makers	Citizen initiatives
Learning	- Formal knowledge: quiz questions	- Interrelation of projects - Externalities	- Multiple choice quiz questions	- Community perspective of renewable energy projects
Storytelling		- Positive multiplier effects - Negative multiplier effects - KW points	- Additional projects - Resources scarcity	- Community points - Hidden effects - Territorial scarcity - Project clustering
Gameplay	- Core mechanics - Movement constraints - Project conditions diversity	- Project conditions diversity		- Three winning conditions
User experience	- Game board resizing	- Points tracking sheet - Tiles blocking parts of the board	- Point tracking sheet	- Re-design project cards - Joker Cards

4.1 *Game designers: playability and core mechanics*

During the participatory game prototyping process game designers mostly contributed to the layers of gameplay and user experience, and to a lesser extent to the learning layer. They observed that the requirements to implement different projects lacked variety, which could inhibit blissful gameplay and entertainment. They proposed greater diversity of necessary project requirements, and prototyped new components such as different amounts of necessary collaborators, ways to get permit, and varying financial conditions. For the layer user experience, different components were either created or adapted: several sizes and density of tiles were tested and the game board was re-designed to introduce higher density of areas where projects are possible to realise. Allowing free movement on the hexagonal grid lead to 'circling around' privileged project locations, so constraints in movement direction were designed. A strong adaptation of a game mechanic was the adaptation of 'chance' (rolling dices): game designers argued the over-utilisation of 'chance' decreases player agency and the possible interactions between players, and created 'quiz questions' as an additional game mechanic.

4.2 *Researchers: storytelling and complexity*

In this workshop, the prototype was updated in terms of the diversity of projects and the variety of requirements necessary for their implementation. New projects included agricultural and infrastructural projects, as well as services such as smart lighting systems, wearable technologies and more. Several features were introduced mainly related to the DPE learning and storytelling layers. The researchers criticised the lack of interrelation between projects and recommended introducing externalities such as NIMBY or multiplier effects, to represent real world complexities. As a result, projects of different types would have either positive or negative impact on their neighbouring projects. One of the effects developed in the prototyping workshop was a positive

multiplier effect multiplying the gains of neighbouring projects, and a negative multiplier effect cancelling out tiles to prevent competing projects from happening. Furthermore, the researchers identified a disproportionate focus on financial management, so they urged for a more prominent presence of the energy output of each project and created the value of KWpoints. Hence, future players could choose whether to prioritise investing in projects with increased financial gain or in projects with higher energy output. A player sheet was designed to keep count of realised projects and resources.

4.3 *Policymakers: accuracy and documentation*

Similarly to the researchers, this group of co-designers also mainly contributed to the learning and storytelling layers of the DPE framework and secondarily to the user experience one. In terms of learning, they appreciated the quiz mechanic and felt challenged by the questions. In the storytelling layer, they demonstrated a strong focus on the existing municipal and regional energy policy, and on the actual urgency and contribution of the projects described in the project cards to these policies. They repeatedly refused to participate in projects they considered unnecessary in real life, even though this was a counter intuitive reaction in the game world. They commented thoroughly on the game content and developed several additions to the library of projects in all categories, such as passive energy saving measures, heat pumps, converting municipal waste into energy, and more. They also noticed that there was an abundance of resources so they introduced a starting condition with fewer resources available to each player. They experienced several difficulties with regards to the user experience layer during the prototyping session. Namely, they found mapping their KWpoints confusing, so they designed a simpler player sheet.

4.4 *Energy initiatives: community and collaboration*

The main concerns of this group of co-designers focused on the storytelling layer and the collaborative aspects of the game. Most notably, the group suggested the introduction of a third value that would represent the community value of energy projects. Other suggestions were that the group dynamics should also be part of the playing process, and that players should be able to block other players' moves or help them realise their projects. They also suggested the possibility to be punished for negative attitudes, for example bribing, by losing one's social benefits. As a result, Community points were introduced, so that each project gives a monetary, energy and community benefit. The winning conditions were also adjusted to accommodate this change. To ensure that project selection would be strategic, the triple outcome of each project was made visible to players in advance, but the effects of each project would remain hidden until after the realisation of the project. A global rule was brought in that projects cancel out neighbouring tiles of different type and double the community points of neighbouring projects of the same type. Finally, Joker cards were added to allow players to secure permits, or finance for their project, counter negative consequences, or sabotage another player's project.

5. Discussion

Adopting a participatory game prototyping approach for the development of Energy Safari illustrates the opportunities and challenges of including stakeholders as informants and design partners in serious game design. This section discusses the differences between the contributions of each stakeholder group to the development of the Energy Safari game. Most contributions were made with regards to the improvement of the game's rule set, and significantly less regarding the refinement of the game hardware. The participatory process also increased the relevance of the game for the stakeholders. The section also addresses limitations of the used method, and proposes potential ways for designers to counter-balance them in future applications of participatory prototyping in serious game design.

5.1 *A rule set with an overly positive narrative?*

The prototyping sessions illustrated the impact of the real-world experience and practices on the design activity, where the participants actively linked game rules to their real-world social and work-related practices. Testing, enhancing and adapting the game's rule set were closely related to the capacity to establish these links. The close link between real-world and game components recurred in all prototyping sessions and stakeholder groups. This observation becomes even more prominent, given that the prototyping was a non-scripted activity, where the topics discussed and the game elements created emerged from the collective and individual concerns of the co-designers without steering by the facilitator.

In games with players from diverse backgrounds and knowledge levels, the expertise of one player in a specific domain is unlikely to be contested by players unfamiliar with the same domain (Eriksen et al. 2014). To prevent the occurrence of this phenomenon and to help maintain the focus in specific aspects of the game, the research team opted for the formation of co-designer groups with shared expertise within the knowledge domain of the energy transition by means of invitation. However, prototyping with rather distinct groups of stakeholders also poses a limitation because the co-designers operated within a group where they were acquainted with each other, share in different degrees compliant 'professional perspectives' and 'speak the same language'. Additionally, they share a rather positive attitude towards the energy transition. Consequently, the developed game prototype might tend towards an overly positive game narrative that is transferred to the game prototype. Future research should examine whether prototyping also with groups including sceptics of the energy transition, would have resulted in fuzzier workshops and edgier discussions, but eventually would also have resulted in a sharper narrative that more realistically represents the real-world complexity, including the existing societal resistance and tensions between different stakeholder groups and their distinctive interests. Mixed groups might also have confronted the individual co-designers to the perspectives of other stakeholders and thus might have resulted in different game components.

5.2 *Little impact on game hardware*

Whereas all groups of stakeholders created new rules and enriched rules designed by other groups, they did not pay particular attention to the physical aspects of the game. The game designers resolved balancing the density and tessellation size of the game board. Subsequently, researchers introduced and policymakers redesigned the player sheet to map players' resources. However not many suggestions came up with regards to other elements of the game, such as the project cards, player avatars and other props. This may be attributed to the stakeholders themselves focusing on issues less related to the game design and more to their own interests and expertise, but also to the setup of the process, which encouraged participants to decide the focus of each session.

5.3 *Rooting of the game in the local context*

Participatory processes add coherence and informed content, ties to real experiences and social practices, and instigate a sense of confidence with and ownership of the final game (Eriksen et al. 2014). Indeed, the participatory game prototyping process contributed to creating enthusiasm around the game to the stakeholders who participated in the prototyping sessions. Many of them showed an interest in the game development process and expressed their willingness to play the final version of the game. Almost all of them joined one of the playing sessions. Since several players are members of existing local energy initiatives, they showed interest in playing the game with other members of their initiatives. Upon their invitation, some of the playing sessions were hosted by such initiatives. This development of a sense of ownership and responsibility about the game points to the game's relevance for the involved stakeholders and the contribution of the participatory prototyping process in embedding the game in the specific local context.

6. Conclusion: balancing stakeholders' input and design output

Aligning with the work of Brandt, Messeter, and Binder (2008) we illustrated that the participatory game prototyping process was crucial to create a balanced game prototype, with an equilibrium between the complexity necessary to address the topic, and the playability and fun expected from a game. Thus, participatory game prototyping where future players are involved as informants and design partners, instead of merely as users and testers (Mildner and Mueller 2016) can be a promising method for the field of (serious) game design. Participatory game prototyping can contribute to games that sufficiently represent real-world complexities, are meaningful for future players, and well embedded in the local context, without sacrificing the 'fun factor' (Winn 2009). In the case of Energy Safari, a series of benefits related to game development can be attributed to the contributions of the co-designers. The playability of the game improved in directions that were not anticipated in advance by the research team, and the complexity of the rules increased incrementally, making it relatively easy for participants to access consecutive versions. The participatory game prototyping process resulted in a broad variety of new, altered and refined game elements that ensure a better fit to the regional context and consequently support learning and capacity building for future

players. It is thus crucial to invest sufficient time to identify and include a significant amount and diversity of stakeholders to ensure a broad variety of perspectives and ideas, also including critical and opposing voices.

Participatory design is often addressed as a two-way learning between 'designers' and 'users' (Bratteteig et al. 2003). What this study makes prominent is that users are not always a coherent group, and addressing the differences between stakeholders can have a positive impact on the participatory process. Our experience with this participatory game prototyping process clearly points out that in non-scripted prototyping approaches, participants tend to engage with, and contribute the most in the domains they are more familiar with. Preventing lock-ins from groups with too little diversity, and balancing the complexity of the game and accessibility to the rules can be rather tedious tasks left to the designer.

The research team tried to implement all participants' input in the game, as long as contradictory situations did not arise in terms of playability. This central role of the researchers demonstrates a limitation of the transformative approach, which keeps the researchers in control of the game development. Thus, critiques on designers maintaining a disproportionate share of control in participatory approaches (Vines et al. 2013; Bratteteig and Wagner 2014) might be the case here too. It is fair to mention however, that participants did not join the prototyping sessions with the intention of becoming familiar with game design. Each individual decided their engagement and time investment in the interviews, participatory prototyping, and playing sessions, based on their interests and availability.

The co-designers who had previously been interviewed contributed both on the level of problem setting for the game goals and on concretising ideas into specific game elements (Bratteteig et al. 2003), acting as design partners, while others participated as informants (Mildner and Mueller 2016). Accommodating different levels of participation contributed to a balanced process in terms of respecting the limited time stakeholders could invest, while engaging them in as many meaningful activities as they desired. A possibility for the future would be to experiment with distributed decision-making during the game design process, and transfer part of the final decision-making to the co-designers. In doing so, it is to be expected that more time for the development process and capacity building in terms of game literacy might be needed to provide the co-designers with tools and knowledge to make informed decisions. Likewise, game designers focused strongly on game mechanics and generic game components. In order to balance domain knowledge provided by stakeholders and playability designed by game designers, also game designers need to invest into learning and capacity building processes to engage in informed dialogues with the other co-designers. A participatory approach requiring such significant time investment for acquiring new knowledge and skills might limit the number of people willing to participate. On the other hand however it could open up a possibility for participatory game prototyping to shift from a technique for serious game design, towards a methodological approach for civic engagement and participation.

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