Social Sciences & Humanities Open 13 (2026) 102377

Contents lists available at ScienceDirect

Social Sciences & Humanities Open

journal homepage: www.sciencedirect.com/journal/social-sciences-and-humanities-open

Regular Article

Time-snaking facilitated debriefings about energy system futures – A megagame case study

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A B S T R A C T

Participation in a Megagame and a consecutive facilitated debriefing can enable large groups to co-construct awareness and knowledge about the complex relations involved in developing sustainable futures for current societies. "Switching the current" is a megagame where 20 to 100 participants collaboratively experience the challenges involved in shaping future energy consumption patterns and energy production solutions for their region, just and sustainable from a social, economic and environmental perspective. This paper explores how collective discussions can be visualized to better understand how in-game experiences are connected to real-world phenomena. Doing so, a time-snake method has been developed which visually depicts how reflective group discussions move between "game content" and "real world phenomena", as well as between "attention to details" and "a broad systems perspective". The comprehensive analysis and comparison of two debriefing sessions shows how participating in a Megagame can develop awareness and understanding of complex relations in shaping sustainable futures of societal energy systems. It also demonstrates how applying time-snake visualizations can help to evaluate the richness of the reflective co-construction that occurs in facilitated debriefings.

1. Introduction

Combining serious games with carefully facilitated debriefings is an important strategy to support the co-construction of ideas about viable paths into possible futures. Understanding how large groups co-construct awareness and knowledge about complex sustainability issues is increasingly important in the efforts to shape a just and sustainable future. Climate change and environmental challenges are intimately connected to human use of energy (Lee et al., 2023). Several initiatives have used serious games to enhance awareness and understanding of energy and climate change (e.g. Barrios-O'Neil & Hook, 2016; Dulic et al., 2016; Wagner and Gałuszka, 2020). ***This paper explores how collective discussions can be visualized to better understand how in-game experiences are connected to real-world phenomena.*** This is done through a case study of debriefings from a large-scale social game about future energy systems called 'Switching the Current'.

By first enabling participants to collectively experience challenges related to shaping a sustainable society in a large-scale gaming situation, and then facilitating reflective group discussions, the process allows them to co-construct an understanding of the complex relations involved in transforming the energy system.

When presenting and analysing the content of the debriefings, the paper also explores the value of using visual depictions of transcribed material, so called *time-snakes*, in the real world and how the discussion moves between attention to details and a broader systems perspective. The time-snakes method allows us to observe how a transcribed group discussion evolves over time from a macro perspective, rather than as themes or individual interactions, which is common in prevailing discourse and conversation analysis methods.

As the multi-domain challenge of transforming the energy system on a societal level is in focus, we begin with a general introduction to energy, climate and society, followed by a discussion about the difficulties in understanding the complexity of the issue, and finally an introduction to gaming as an approach for facilitating a systemic understanding of societal transformation. Next, we present our research design (how time-snake data was collected and analysed), the research results (time-snakes for different parts of the debriefing sessions of two game sessions) and conclude with a discussion and conclusion section.

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https://doi.org/10.1016/j.ssaho.2025.102377
Received 6 February 2025; Received in revised form 9 December 2025; Accepted 15 December 2025
Available online 6 January 2026

2. Facilitated debriefing as method to co-construct understanding of complex relations

Based on Kolbs experiential learning theory (Kolb & Kolb, 2009), Crookall (2010) argues that debriefing is the processing of the game experience to turn it into learning. Or more boldly stated in other words "*the learning comes from the debriefing, not from the game*" (Crookall, 2010, p. 907). Hence, "To conduct a gaming simulation without including adequate debriefing is ineffective and even unethical" (Kriz, 2010, p. 669). Debriefings are a crucial component in the sense that this is the first opportunity given to the participants to reflect upon their strategies and choices, and also share the perspectives of other participants (Crookall, 2010; Kriz, 2010; Lederman, 1992).

Combining serious games with carefully facilitated debriefings is an important strategy to support the co-construction of ideas about viable paths into possible futures. Possible futures demand the establishment of joint visions shared by a multitude of actors, suggesting that dialogues between a broad range of actors are required to understand and connect the present and future of human society in a context of environmental and climate change (Neset et al., 2020).

Kriz (2010) proposes a systemic-constructivist approach to facilitation and debriefing adopted in the study reported in this paper. This approach considers learning in games as a problem-based, social process where the competences of the participants must be highlighted to support perspective-taking. It is thus a form of collaborative learning based on joint reflection upon own and others action in the game.

According to Kriz, debriefing "*refers to the methods used to combine participants' reflections on their experiences with assessment of mental (cognition, emotion, etc.), social (action, communication, etc.), and systems processes (change of resources, structures, etc.) to deduce applications for real situations beyond the gaming simulation experience.*" (Kriz, 2010, p. 669). Learning is thus not only a product of game mechanics and scenarios, but also the interaction that takes place between the participants during and after the game (Vervoort et al., 2010). Kriz' view on learning is constructivist in the sense that the participants actively construct their understanding of the game, and the world, through interaction with the game and each other (Boyle, Connolly, & Hainey, 2011).

The co-construction is systemic as it challenges own perceptions of how the world works by being exposed to the perspectives of others, forcing the participants in a game to acquire new views to be successful, as well as the ability to recognise several possible outcomes of a game, and thus also potential futures. Kriz emphasizes the need for reflecting on the possible meaning of the game's outcome in real-life situations. A good facilitator can support this process by utilizing different tools. Kriz suggests that debriefings should be divided into six phases, which has been used as the foundation for the debriefing protocol used in this research. In addition, Barrios O'Neil and Hook argue "*facilitating productive dialogue among stakeholders is a key component of achieving larger sustainable energy goals*" (2016 p. 127). This paper utilized such a large-scale social simulation-game, a *megagame,* to allow for large groups of participants to encounter, and through debriefing sessions discuss, complex relationships in societal transformation.

3. Understanding complex systems

Dealing with complexity require systems thinking, here implying the ability to understand sustainability challenges and solutions that span different scales and domains, including actors, causality, inertia between different parts of a system, and feedback mechanisms. A basic concept in systems thinking is the ability to switch between, or at least be aware of, perspectives and analytical levels.

To engage with the challenge of complexity a number of strategic competencies are proposed within the field of education for sustainable development, including systems thinking, critical thinking, emotional and normative competence. The latter is the ability to reflect on choices by being able to map, specify, apply, reconcile, and negotiate sustainability values, principles, and goals (Brundiers et al., 2021; Vare et al., 2022). Developing strategic competence is at the core of learning for sustainable development, which entails designing learning in such a way that individuals are dispositioned to contribute to sustainable development. Developing such competence requires *new ways of learning* so that people can engage in learning situations and become aware of the complexity of the sustainability challenges.

4. Energy systems, climate change and sustainable societies

The main contribution to climate change on behalf of human activities can be attributed to the energy sector, and hence one of the primary challenges in dealing with climate change is to eliminate emissions from fossil fuels (Lee et al., 2023), without a damaging leakage of effects to biodiversity (Rehbein et al., 2020) or fairness (Siciliano et al., 2021). Efforts to improve human understanding that empower change towards a more sustainable energy system are thus fundamental if we want to reduce our impact on the climate (Steg et al, 2015; Funke, 2021; Roychoudhury et al, 2017).

From a technical point of view, the energy system is a highly interconnected, multi-national construct, a complex system in its own right. Moreover, such a technical energy system is tightly coupled to the financial system and the societal system as it provides and depends upon several core services in society. Transforming the energy system into a sustainable system is challenging, not only because it is expensive and technically challenging to re-design it – it is also challenging since it will demand adaption of society at large in terms of energy consumption behaviours. Issues like the amount of energy used, from what power sources, at what time it is consumed, and for what reasons, all impact the possible avenues and outcomes of creating a sustainable energy system. Thus, grasping the complexity of the energy system demands solutions that comprise both social and cognitive dimensions as well as the financial and technical perspectives (Fraune, 2015; Geels et al., 2018; Sovacool et al., 2020). Indeed, the ideas of an "energy system" or a "societal system" are human constructs – in reality all of these are parts of an overarching suprasystem of which climate change is one process (Jorgenson et al., 2019; Yearley, 2009). Finally, from a political perspective, it is not enough that this kind of knowledge exist, we as humans need to learn together in order for the knowledge to be a legitimate resource in risk management and societal transformation.

5. Switching the current – a megagame for shaping a future energy system

Social gaming, as a way to support reflective communities (Fischer, 2007; Hofstede et al., 2010; Kriz, 2010; Lukosch et al., 2018; Vervoort et al., 2010) can be seen as an effort to move from individual reflection to joint reflection. Using gaming to improve understanding of complex systems, and perform research on how people understand complex systems, is not a new idea (Barrios-O'Neil & Hook, 2016; Hofstede et al., 2010; Lukosch et al., 2018; Rooney-Varga et al., 2018; Rooney-Varga et al., 2020). The megagame used and developed for this study is Switching the Current (STC), an initiative that embodies a transdisciplinary research undertaking under the patronage of the Swedish Energy Agency. Its fundamental aim revolves around creating and conducting a series of megagames where the energy framework and its ramifications on the adjoining societal, environmental, and climatic milieus are in focus (Uhrqvist, 2025). Large-scale gaming simulations have been found useful for engaging large groups of people who are part of an organization that needs to change to make them feel empowered to be part of a change process (Hofstede et al., 2010). A primary objective resides in the enhancement of discourse and interconnection among entities vested with the stewardship of the energy structure and other pertinent stakeholders affected by, or affecting, the energy system (see more in Hofstetter et al., 2024; Uhrqvist, 2025). In the megagame, participants learn to understand issues based on what options are available and to see them from the perspectives of others. Megagames can thus be said to have a “participant-directed structure” (Belton & Dillon, 2021, p. 3).

5.1. Structure of Switching the Current

The game-world experienced by the participants in the megagame represents a region and its energy system, based on data on real orders magnitude of resource use and a complex web of relations between actors.

In the STC, participants are designated as emissaries representing assorted constituencies and functions within the societal framework. The participants are assigned to three distinct population strata categorized as High, Medium, and Low-Income cohorts, alongside pivotal entities including a power distribution firm, a power and district heating producer, the municipal council, a fuel producer, and a regional industrial establishment termed. Local adaptations of the game configurations are made depending on the target group and geographical area in which the game is conducted. Such adaptations have been pointed out as important for creating engagement from local stakeholders (Dulic, Angel & Shepperd, 2016). The pragmatic instantiation of this framework entails an arrangement characterized by an assemblage of tables, upon which are arrayed diverse ludic elements concretizing the foundational attributes of each stakeholder entity. The board-gaming like aspects of the game, offering tangible interaction with the game as well as physical venues for meetings, allow the participants to explore the complexity of the energy system and support engaging discussions about contradictory aspects of energy management (see Fig. 1).

5.2. Procedure of a Switching the Current event

This paper focuses on the post-STC megagame debriefing sessions, but to put them in context, a brief description of an entire megagame event will be presented here. In the STC project, all megagames begin when the participants arrive. They sign a consent form and answer a survey consisting of background questions about what kind of games they play, how often, if they work with energy or sustainability, and naturally domestic information about perceived gender, age, education etc. Each participant is assigned to a specific role in the game which also describe what objectives the participant has in the game. Then, an introduction to the project, and the rational of the game is given by the STC project members. This lasts for about 20 min. After that, an introduction to the game is given. After that, the first round begins. Each round lasts for 30–60 min, and typically 4–5 rounds are played, including a lunch break after the second round. When the game is concluded, the participants answer a new survey about their experience

Fig. 1. Participants engaged in a Switching the Current megagaming session. All depicted have approved the use of this picture. Picture by Thor Balkhed.

of the game. Then the participants are divided into smaller groups (10–15 participants) and the debriefing begins. As the last part, the participants gather and are presented with the different outcomes of their game and a general discussion. Typically, the whole procedure lasts between 6 and 7 h.

5.3. Debriefing of Switching the Current

Central to the megagaming process is the reflection phase conducted directly after each game, the debriefing. The debriefing is conducted by a facilitator that asks the participants questions according to the STC debriefing guide (see further below), and an observer who takes notes during the discussions. All debriefings are recorded on video and audio. The STC debriefing guide is based on the six phases described by Kriz (2010), but minor alterations have been made to fit the megagame format. In line with Kriz (2010), the protocol states that the facilitator should try to get answers from at least three participants before moving to the next phase. The role of the facilitator is not to feed the discussion (becoming a part of it), but to avoid placing own, or the project groups’, perspectives in the discussion. Further, the facilitator should tolerate ambiguity, as the megagame format creates a complex and unpredictable situation that can trigger different responses from the participants. Finally, the facilitator needs to provide enough time for reflection. Silence is not the enemy in the debriefing session – instead it is necessary to allow the participants to reflect upon their experiences. Enforcing progress to the next question or phase harms the ability to achieve the debriefing objectives.

Several of the original questions proposed by Kriz (2010) were merged into the same phase. The STC debriefing guide consists of five phases, including the following questions:

Phase 1: What happened during the game, and how did you feel?

This phase aims to allow participants to describe the most important events and release tensions built up during the game. A megagame creates a lot of strain on the participants as they engage in a confusing social situation where the ‘rules’ often are unclear in the beginning. Having their immediate reaction is valuable, but also important for the participants as they likely will understand that other participants also felt frustrated and confused.

Phase2: What did you learn, and what connections exist to your daily life?

This phase is intended to support the build-up of cognitive structures as the participants connect the “what happened” and “how did you feel” discussions with reflection upon their own learning and potential relevance for their everyday lives. The aim is to generalize the unique experiences (Kriz, 2010). It also allows for scrutinizing the relations between the game and everyday life, a kind of validation of the experiences in the game.

Phase 3: Did you get new perspectives on the energy issue through your participation in the game and the discussions with other participants?

This phase focuses specifically on aspects of energy, society, and climate change. The participants have most likely already touched upon this in the previous phases, but to ensure that these aspects, which are learning goals in the STC project, are not missed, a dedicated phase is used. Further, the participants are encouraged to look beyond the game mechanics and also consider if the interactions with other participants have supported this type of reflection.

Phase 4: What do you bring with you from the game – will it impact your actions in your everyday life?

This part of the debriefing develops the previous question "what connections exist to your daily life?" by asking the participants if the game could affect their future behaviour. This is yet a step in the process of generalizing experiences from the game to the real-world context.

Phase 5: Could you provide some pros and cons? What did you like in the game? What should we change or add?

As a final step, attention is turned to the design of the game, moving back from the more general discussion with the intention to capture experiences important for the re-design of the megagame. The STC project uses an iterative design process, meaning the megagame is a continuously evolving living product. Insights about the game design are also collected through surveys and observations, but the debriefings provide a unique and immediate format for understanding what aspects of the game should be kept, changed, or even discarded.

6. Research method

The research approach applied in this study follows an interpretative philosophy and a qualitative research strategy (Patton, 2015, pp. 31–33) aiming at understanding what participants learned when reflecting on their collective megagame experience during a facilitated debriefing. More specifically, the aim was to reveal how the megagame enabled co-construction of understanding of complex relations regarding energy system transition and shaping viable futures of sustainable societies.

6.1. Case selection

As this paper is written five STC megagames have been conducted (see Table 1).

All results presented in this paper are based on the debriefing sessions from "Woods Town" and "New Town 2". These two were selected as they were the most comparable in the sense that the participants had an interesting mix of practitioners, policy makers, and scholars in relevant fields. Also, the data analysis showed that the debriefing sessions turned out differently in those two games, which makes them especially interesting for further analysis from a qualitative research perspective.

6.2. Data collection

As mentioned above, the debriefing sessions were recorded on audio and video. Sound was transcribed in two steps: first by running the Dictate function in MS Word on the audio file, and then by carefully listening to the recordings and correcting the transcriptions. Transcriptions correspond to verbatim level, without overlapping speech or micro pauses. All utterances are marked with speaker represented by a number, and timestamp. Video recordings were only used rarely to verify that utterances were connected to the correct speaker.

The data used for this paper comprise a total of 150 min transcription (Woods Town: 72 min; New Town 2: 78 min) of facilitated multi-party conversations from the debriefings conducted after two megagames. In total 53 persons participated in the debriefings.

6.3. Data analysis

To present and compare the outcome of the debriefings, a two-axis space, a time-snake space (see Fig. 2) was created. The purpose of creating the space was to be able to show how the discussions moved (like a snake through time) between issues regarding both in-game aspects and out-of-game aspects, as well as from detailed, or personal reflections towards holistic aspects such as energy and climate change on a societal, or even global, level. The purpose of the time-snake is thus to show how a discussion unfolds along two dimensions, not to demonstrate the value of the discussion as such. The time-snake is only a way of visualizing how the discussion develops over time. In this study, the value of conducting the time-snake analysis is to see how the discussion evolves from discussing specific events in game to discussing the connection between events in the game and real-world issues. In order to achieve this, each 30-s part of the debriefings was judged according to the two dimensions. Ratings were conducted independently by three researchers. When a conflict in rating occurred, the particular 30 s passage was reviewed together and a final score was settled in consensus between the researchers.

Utilizing this analysis methods allows for presentation of individual excerpts that illustrate the type of discussions that took place during the debriefings as well as presenting and comparing a holistic description of the debriefing sessions that allow for comparison between the Woods Town and the New Town 2 games.

The overview of the coding is further elaborated in Table 2 (below) where the two axes are given some more substance followed by an illustrative example.

Applying the coding guidelines naturally demands in depth knowledge of the debriefing sessions. The coders took part in the debriefings and worked with the transcriptions used as a basis. Coding was conducted individually while listening to the debriefing recordings and reading the transcripts.

6.4. Ethical considerations

This research has been approved by the Swedish Ethical Review Authority (Dnr 2022-06150-01, approved 2023-01-25). All participants were informed about the purpose of the study and signed a letter of informed consent.

7. Results – connecting game and reality, details and system

In this section we explore how the participants during the debriefing sessions co-construct an understanding of the game in relation to real-world issues. This analysis shows how the different kinds of questions asked in the debriefing create different patterns of connections. Understanding this is valuable for aligning future debriefing design with desired kinds of focus in discussions. As a general picture, this tracing of how the discussion moves along the two axis' show that although there are significant similarities between groups, they also show the unique character of each debriefing. We compare two different debriefings, the Woods Town game and the New Town 2, who had similar participant groups (see Table 1), and scrutinize each debriefing phase in an effort to explain how the discussions moved along the two axis's. Excerpts are

Table 1
Overview of empirical material.

Game	Number of participants	Mean age	Educational level	Type of participant
New Town 1	18 (M = 4, F = 14)	36	University	Municipality officials
Student Town	25 (M = 11, F = 12)	29	University	University students
Woods Town	24 (M = 10, F = 14)	47	University	Climate researchers, policy makers, private companies
Coast Town	79 (M = 47, F = 32)	19	High school	Upper secondary school students
New Town 2	27 (M = 17, F = 10)	44	University	Municipality officials, Researchers, policy makers, private companies

Fig. 2. Categorization in the Time-Snake diagram.

Table 2
More detailed coding support.

Level	Holism and system	Out of game
High	Comments on the level of relations between large scale systems at a global level, e.g. Climate change, global economy, global energy flows.	Direct reference to things happening outside of the game, with no resonance with the game event, e.g. geopolitics to local nature conservation.
Mid high	Dependencies between actors of phenomena on national or regional scales. e.g. Biodiversity or food systems. A region is seen as all the (game) actors together.	Personal reflections with unclear connection to the game, e.g.
Mid low	Dependencies between local actors, e.g. energy suppliers and consumers, well-fare providers and citizens.	Relate to personal experience or occupation with a weak connection to events in the game, e.g. social relations, commuting or other practical problems
Low	Dependencies within individual entities, e.g. within game teams, companies, organizations or neighbourhoods.	Real-life examples directly linked to an in-game events, e.g. relating public transport in the game and reality.
low	How two things on the gaming table are connected, e.g. happiness and carbon dioxide emissions.	Focus on events in the game but with connection to realistic events, e.g. news reports, major in-game happenings.
Mid low	Specific relations between components, e.g. good/bad a relation with … or what is the connection between …	Internal realism of the game, e.g. it went well/badly for that table, certain rule or interaction for specific game parts.
Mid high	Personal level, the role with no explicit connection to other components/phenomena, e.g. I found it difficult to be a manager, my role was difficult to play	Personal relation to specific content or relations, e.g. frustration, happiness, irritation
High	Specific and isolated rules or components, or an extremely specific topic from reality.	Specific components in the game, e.g. carbon dioxide stones, a rule or money.
Level	**Detail and personal experience**	**In-game**

used to illustrate the examples.

Phase 1 What happened during the game, and how did you feel?

During the first phase of the debriefing, the participants are encouraged to describe what they think happened in the game and how they felt during the game. This type of questions brings the discussion towards the in-game side of the graph, but not necessarily towards the lower spectrum on holism. In the New Town 2 discussion, only a limited number of episodes (a total of 60 s) occurred where participants focused on details in the game compared to Woods Town where 150 s were spent discussing such matters, also on an even more detailed level (see Fig. 3 Categorization in the Time-Snake diagram).

The *New Town 2* discussion begins by participants describing stress and frustration in the early phases of the game (speakers 6 and 3, see excerpt 1), but when doing so also pointing out that once an overall understanding of the game was gained, one could take action (speaker 6).

This is followed by similar statements moving mainly towards reasoning about the game on a more general level. Participants 9 and 2 initiates a discussion about the positive aspects of the gaming format, and the positive attitude of the participants when facing a complex problem ("It's cool to be able to play such a game with people you haven't met before, with strangers who manage to cooperate this well. I think that's strong"). Participant 6 joins in by adding that "The day has gone by very quickly" as everyone was very dedicated to the task even though it was complicated, which receives confirmation from participant 7 "Yes". The participants initiate and support the shift from individual feelings of frustration to the more overarching, and positive, aspects of participating in the game.

Excerpt 1. New Town 2, phase 1.

00:00:48 Facilitator: Oh, hi. I hope you've had fun. So, we're going to have another brief. I'll pose some questions, and you can talk about these questions and make your voices heard. So, I thought I'd start with: what happened in the game and what emotions did you feel during the game? So, I'll leave the floor open, so just go ahead.

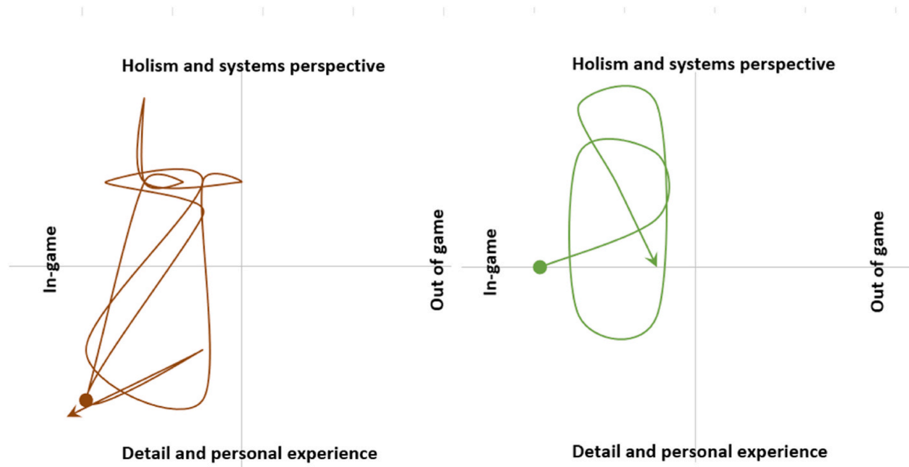

Fig. 3. Time-snakes illustrating how the discussion moved in the New Town 2 debriefing (left) and the Woods Town debriefing (right). As can be seen, the Woods Town discussion focused on details and individual reflections to a higher degree than the New Town 2.

00:01:37 Speaker 6 Stressful to begin with, maybe towards the end too, but more control, and it was a lot more fun towards the end as well, so you got a much better understanding of how you can influence things.

00:01:52 Facilitator Yes. [X] will take some notes. Any more thoughts on what happened and how it felt?

00:02:02 Speaker 3 I always felt a bit of frustration, you know, when you go into this type of game, similar things, and it's just that you don't understand the whole picture. You really want to grasp it, but you don't, so for me, it started with a bit of frustration, I must say, and then you have to start acting on some small thread.

00:02:26 Speaker 9 It felt like there was so much energy in the game. Normally, in everyday life, after lunch, (inaudible) it shows what power there is in the game format. It's cool to be able to play such a game with people you haven't met before, with strangers who manage to cooperate this well. I think that's strong.

00:02:51 Speaker 2 Yes, it's nice that it opens for a dialogue. I think it's fun to be here today, and I think that's an important component, even if one was very frustrated at the start, to share that kind of thing today.

00:03:09 Speaker 6 The day has gone by very quickly, so it was just that everyone dedicates themselves to the task, and there's nothing that sorts this is hard or that one doesn't understand, but you test and see what happens, kind of. So, it's a very good attitude that everyone had, I thought, even though it can be very complicated.

00:03:29 Speaker 7 Yes.

When comparing the New Town 2 game and the Woods Town game, we find that the former made more movements up and down on the axis describing individual or detailed statements about feelings and more holistic reflection about consequences of own actions than the Woods Town discussion. As shown by Excerpt 2, these were at time intervened in the sense that the feelings were connected to an awareness of the higher-level consequences of actions, or lack of action. The New Town 2 discussion was also marginally longer (60 s). It started with a statement about an individual observation where one of the participants expressed frustration over not understanding the game when it started, resulting in a feeling of powerlessness. Then, the same speaker swiftly moved to a more holistic topic explaining that it was hard to understand what other players were doing (Excerpt 2), and the difficulties in following and understanding the consequences of their own actions in the game.

Excerpt 2. Woods Town, phase 1

00:03:39 Speaker 7 I can start with saying that my first feeling was confusion, and as the confusion continued to increase, it turned into powerlessness. And I get it. I don't just get it. We were supposed to do something right. Everyone just ran around, I thought, and I felt like I couldn't make sense of it at all. It might be because there are too few of us. I don't know if that's the reason because I… I don't know what you business people were doing. Because I never talk to you, so, then we have—

00:04:10 Facilitator —then you create a very nice bridge to what happened in the game. Have you made sense of it?

00:04:17 Speaker 7 In the end? No, I'm still in the confusion. Yeah. We really … Because the conditions changed when we thought we were doing something good, we got pushed back, you know. Then there were negative consequences when we thought we were creating positive consequences, so that's part of this powerlessness, I felt, you know—

00:04:38 Facilitator Confusion and powerlessness? Oh wow, then we'll look around to see if anyone else wants to jump in. Thank you, yes.

00:04:46 Speaker 9 But I can share a bit. I feel a bit of guilt in a way, a slight pang of conscience, like oh my God. I don't know, as a high-income earner. Yeah, but what can we do, you know, not everyone in the population is doing well. Yeah, it felt like, yeah, but a bit of frustration, guilt, a pang of conscience in a way, but a lot of confusion like, what should I do? What …? Yeah. I felt, yeah. Yeah, then I'm completely taken by the day. Completely exhausted.

This is followed by similar reflections, for example another participant felt guilty about not having helped other players although it was possible. However, there were also several statements concerning details in the game that were difficult to understand from the point of view of the participants, which explains why the discussion moved into the detailed half of the holism scale.

Phase 2 What did you learn, and what connections exist to your daily life?

In the second phase, the two examples position themselves in roughly the same areas. As can be seen this phase tend to move away from the detailed level on the holism axis compared to the first phase, and often goes into the out-of-game region. This could be a result of the questions asked as generalising from events in the game to daily life likely will induce examples from real life, moving the discussion away from in-game aspects. The phase lasts for 360 s in the New Town 2 debriefing, and 300 s in the Woods Town debriefing. The Woods Town phase stretches further into the in-game zone than the New Town 2 phase, suggesting that the Woods Town participants anchored their discussion in details of the game to a large extent than the New Town 2 group (see Fig. 4).

A central theme in the second phase is the challenge of getting an overview of the interactions in the complex context that the game

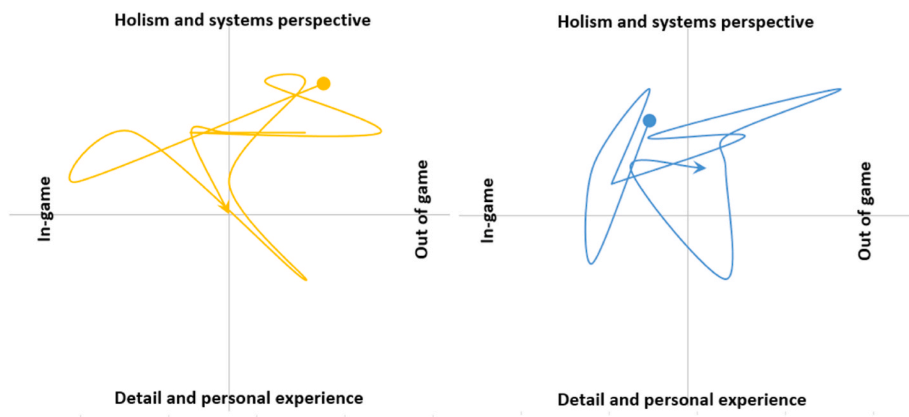

Fig. 4. Time-snakes illustrating how the discussion moved in the Woods Town debriefing (left) and the New Town 2 debriefing (right) during Phase2.

provides. In the discussion the participants emphasise the need to step out of one's own bubble and talk with a broad range of other actors, especially when it comes to synchronize actions when time to negotiate and plan is limited. Simultaneously the discussion points to the challenges of grasping the direct effects of isolated choices in a system with many feed-back loops. Also, the importance of relevant system boundaries is stressed.

Excerpt 3 New town 2

00:07:12 Speaker 11 We also shifted our approach to be more out there and gather the information we need. At least I went around more to see what the problems are now. Like, what is happening so we can address it here and what is needed to solve this? Instead of just looking and waiting for things to happen, what can we do in our bubble, so to speak.

00:07:34 Speaker 6 And like, the regional authorities did a lot of things. Now we have electric buses too. Yes, we ordered them? Apparently!? No, but if we had done another round, I would have gone out more like you. I feel like I fell behind. There was so much else all the time, like demanding payment on loans and such, it was …

00:08:01 Speaker 10 Go ahead.

00:08:02 Speaker 8 But it visualizes how everything is connected. Maybe you don't think about it much otherwise. Someone makes a decision here. Suddenly there's an increase here, and in that way, it becomes a game where you experience the consequences quite quickly. In one day, we have experienced the consequences of our choices for several years ahead, so I think …

00:08:37 Speaker 11 It was so strange when it becomes like that, like math language, so discreet, like it becomes points five years apart. There's no feedback on anything until suddenly five years have passed, and these effects come with numbers on quality of life and plus/minus on money and such. And then you do other things, and five years pass, and suddenly all the numbers are thrown up in the air and become completely different. But in real life, you keep up with the effects more continuously. Here, it becomes more like snapshots.

00:09:19 Speaker 13 I think the importance of realistic simulations is incredibly high due to this complexity. Now we were at the regional level; we didn't even throw the EU into these rules, which would change everything even more, but like bigger swings. It would be very interesting if it is possible to simulate something similar where you can really get good data.

00:09:57 Speaker 10 It's also what you started with, learning to learn together. I think that's so important because we have a hard time grasping the complexity, and then we are incredibly different too. Some run fast. Some want more facts before making decisions, and so on. Sometimes you need to see the whole picture before starting somewhere to understand what has the most effect or what will take us to the next step, so to speak. And there, it's a bit exciting, what you say too, what do we have control over locally? What is a regional issue, what is national, what is international? That can also affect things.

This excerpt also shows the tension between the pro-active gathering of information of what is going on in relation to the experience of occasional (discrete) presentation of data about what happened. A good balance between these might be a crucial factor in navigating transforming complex systems. And as a third participant mention, it visualizes that in real life, as well as in a game, there are differences in how problems are approached.

In total the participants state that the primary learning outcomes was an increased awareness of the complex character of the energy system, especially in times of rapid and partly unforeseeable transformation.

Phase 3 Did you get new perspectives on the energy issue through your participation in the game and the discussions with other participants?

In the third phase, the question of new perspectives on energy is discussed. This phase focuses specifically on aspects of energy, society, and climate change. The participants have most likely already touched upon this in the previous phases, but to ensure that these aspects, which are learning goals in the STC project, are not missed, a dedicated phase is used. Further, the participants are encouraged to look beyond the game mechanics and also consider if the interactions with other participants have supported this type of reflection.

This is a topic that differs between the two debriefings. They differ in the amount of time spent, but also in the type of discussions generated and the extent to which they lead to co-production among participants. In Woods Town, this has become a short part of the debriefing, while in New Town 2 it has prompted a long discussion that has also picked up many different threads (see Fig. 5).

In the debriefing in Woods Town (1), 19 min in, the facilitator asks if the participants have gained any new perspectives on the energy issue. The question is followed by a long silence before participant 5 begins with a reflection that there was less focus on the energy issue than they had thought and wonders if it might also have to do with their role in the municipal leadership. Participant 7 continues the discussion and agrees with the thoughts on the energy system but also reflects that the energy system is more complex than they had thought and that new ways of thinking might be needed. They describe that the day was still a bit of a wake-up call.

Excerpt 4 Woods Town

00:20:50 Speaker 5 I can start. I was perhaps thinking more along the lines of reflections. Now, I belonged to the municipal leadership, so the roles are different, but in my role, there was a little less focus on the

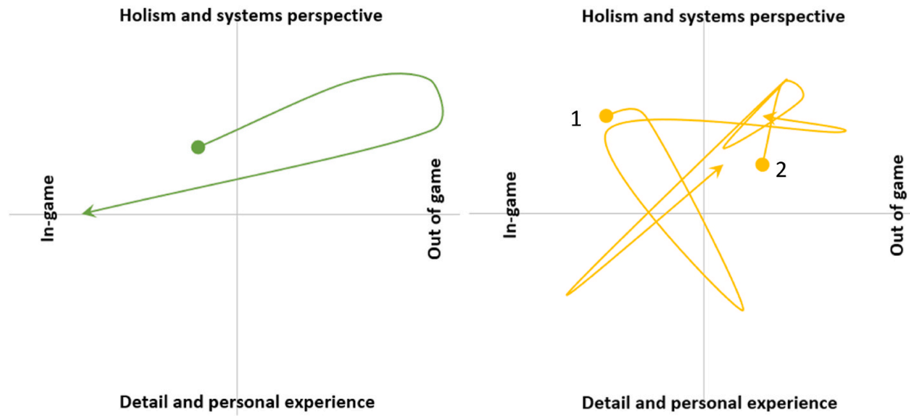

Fig. 5. Time-snakes illustrating how the discussion moved in the Woods Town debriefing (left) and the New Town 2 debriefing (right) during Phase3. The right figure is divided in two snakes since the discussion became divided in two parts.

energy issue. I had perhaps thought that I would reflect more and have more thoughts about energy and the energy system. I feel that it ended up revolving around health and welfare and spinning around in some loop, so there was perhaps less focus on energy and the energy system than I had thought. That was my reflection, but it might have to do with the role I had as well.

00:21:27 Speaker 7 I agree, because I also felt that it disappeared and my reflection over the talk is that this is much more complex than one might actually have thought. And I don't think we are really there yet with the whole energy issue; entirely new ways of thinking are needed which we don't have yet, we aren't there in our mindset, but we have to think completely differently to solve the energy issue, because based on today's session, at least from my experience, what we have today and are juggling with won't be enough. It won't work. We have to find something else too. So it was a bit of a wake-up call for me, I think.

When participant 1 continues, the focus is on complexity and collaboration. However, the participant also brings up how the energy issue in society has changed recently and for many has gone from being a non-issue. This also leads to questions about knowledge and understanding. Here, the conclusion is also drawn that it is important for the public to have knowledge since it is also an area with many interests and where there is also some deceit. Participant 6agrees by also mentioning the occurrence of manipulation. Participant 3 continues by stating that they have not learned anything new about energy. Participant 8 mentions that the experience has still been a confirmation of the complexity of the energy system. Before a new question is raised, participant 3 concludes by saying that the real-world energy system is even more complex. In Woods Town, the discussion moves within the two upper fields, meaning it is more about holism and systems perspectives than details. However, there is movement between the left and right fields, indicating that it is a discussion transitioning between 'Reflections on the game as a whole' and 'Reflections on society as a whole'. The discussion centers on what is included in the energy system, the participants' expectations before the game, and whether the experience has broadened their understanding of the complexity of energy issues.

In New Town 2, 13 min into the debriefing, the coordinator asks the same question, if they have gained any new perspectives on the energy issue by participating in the game. For nearly 10 min, the participants reflect on this. In New Town 2, the discussion moves across all four fields. They discuss holistic views of the energy issue, an understanding of the relations between parts and the whole, and the learning that occurs through role-playing. They also reflect on how conditions change during the game and acknowledge the difficulty of implementing system changes and making decisions.

Speaker 4 begins by stating that, even though they haven't learned much new, they realize how important flexibility is. Another participant, speaker 12, agrees and remarks that it's like a balancing act.

Excerpt 5 New Town 2.

00:14:02 Speaker 12 Yes, I agree that there are so many actors and interests, or yeah, so it swings back and forth. It's like, I don't know, like a balancing board; if we do something, then the next round, it's completely the opposite.

Later participant 3 addresses how much external factors outside of Sweden's energy system have an impact. Participant 6 also reflects on how they have gained a better understanding of the bigger picture and emphasizes the importance of finding the connection between the overview and the details.

Here, there is a link between the game experience and one's own experiences, knowledge, and thoughts about the energy system. In some areas, it's not always entirely clear which sphere is being referred to — the game, reality, or both. In others, it is more evident. The connection between the game and reality is discussed when one of the participants highlights the importance of testing different roles.

Excerpt 6 New Town 2.

00:15:32 Speaker 6 You also learn through the roleplay how difficult it is, with many actors involved, if you want to make a change somewhere. It requires talking to everyone at the same time, but then those conditions might change when you get to the last person you need to talk to, and then it might not go through. So, it shows that you learn directly how challenging it can be to implement large system changes in that way./ … /.

The discussion about the roles then transitions into a conversation about the types of people participating in the game. One participant mentions that during the coffee break, they discussed how everyone present that day is interested in climate issues, which influenced their decisions in the game. In the debriefing group, they continue to reflect on how it would have been interesting if there had been participants with more critical views, such as climate skeptics. This leads to a broader discussion about climate issues, sustainability, and a reflection on what might happen if, for example, climate skeptics were included. The final discussion before moving on to the next question focuses on sustainability transformation, goals, and to what extent they took initiative and went beyond their role descriptions.

Phase 4 What do you bring with you from the game – will it impact your actions in your everyday life?

This part of the debriefing develops the previous question "what connections exist to your daily life?" by asking the participants if the game could affect their future behaviour. This is yet a step in the process of generalizing experiences from the game to the real-world context. The

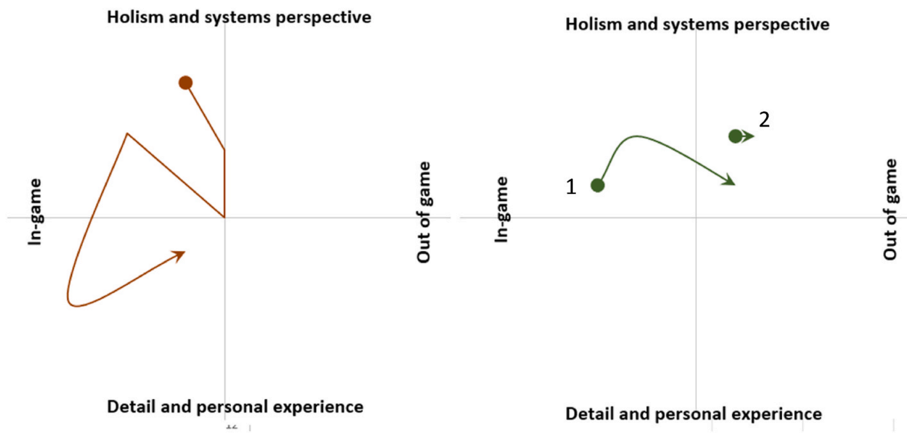

Fig. 6. Time-snakes illustrating how the discussion moved in the Woods Town debriefing (left) and the New Town 2 debriefing (right) during Phase 4. The right figure is divided in two snakes since the discussion became divided in two parts.

Woods Town discussion remain largely towards the in-game aspects, and made some movements towards the more specific aspects of the game. The New Town 2 discussion mainly moved along the in-out game axis, and the discussion largely concerned more holistic aspects of the game as well as the real world (see Fig. 6).

Speaker 9 begins by referring to in-game events and how the shared objectives of the players was reflected in the outcome of reducing emissions (Excerpt 7, when mentioning “the stones”). Speaker 6 joins the discussion, but cannot entirely relate to speaker 9 as his role never received any direct feedback concerning emissions. Speaker 12 makes a shift in topic to previous experiences of working with similar issues through workshops, and stresses the advantage of the gaming format.

Excerpt 7 New Town 2

00:22:24 Speaker 1 What you take away from the game will influence how you act in everyday life moving forward.

00:22:45 Speaker 9 I think that at Elementa, we could see how it aligns (inaudible). We quickly went from ten stones to two stones in three to four

Rounds (inaudible), as long as we have roughly the same goal and act in the same direction, we can handle this. So, I thought it was impressive that we could see that.

00:23:10 Speaker 6 We didn’t look at the region, at least not from my perspective as responsible for health, uh, and education emissions. However, we didn’t see what it looked like in the entire value chain, and we had no personal emissions unless we hired labour from abroad. So, in that way, there was nothing to relate to in the change—if I bought that game during the second round of sawing, I think.

00:23:48 Speaker 12 I take with me the whole concept, really playing to learn. We don’t do that much today; you know, you have your workshops or things like that, but games really engage everyone in the same way, it (inaudible).

In the Woods Town discussion, participant 4 initially reflects upon the possibilities to “get people to embrace a new idea or make an investment” and that participating in the game added to personal experience. 4 continues by describing that it was fun to work with people that do not normally work with energy issues. Speaker 9 brings the discussion further into the game domain by starting a discussion about the possible values of the megagaming format, suggesting that the format should be down-scaled to become easier to understand, but the participant still endorse the game format. Similar statements are made by participant 1, picked up by participant 5 who states that it is “educational even if it’s fictional”.

Excerpt 8 Woods Town.

0:23:39 Facilitator Let’s continue. What do you take away from the game? Will it in any way affect how you act in everyday life moving forward, and in everyday life, broadly speaking—at work, privately, or in other contexts? What do you take away from the game? And will it affect how you act in everyday life moving forward?

00:24:12 Speaker 4 Yes, it’s like an additional little piece of the puzzle to understand how complex it is to achieve change and get people to embrace a new idea or make an investment. I know it’s difficult, but now I’ve gained some personal experience that may have stuck with me a little bit. I think it just adds to the pile.

00:24:48 Facilitator Anything else? Yeah, I’ll send it over.

00:24:52 Speaker 4 I think it was fun to do this together with different people. I work with energy issues and energy technology, which may not always be just energy issues, but working together with people who don’t work with energy, seeing how they view this.

00:25:19 Speaker 9 It’s partly, I think, my presence today that it was partly about the game’s method. How does a Megagame work for our target groups, which are children and young people? How could it be used there? And I think you might need to narrow it down to something much clearer, not on such a large scale, to be able to implement it because now we found it so extensive. If you let a group of 15-year-olds dive into this, it could become even more confusing, but I absolutely see that this type of method, where you get a role and have to solve things, involves negotiations. But maybe it needs to be more guided and clear, with the help of cards, or maybe a bit more support. And then, what more would I say? It’s about how you can incorporate it into your own work somehow.

00:26:30 Speaker 4 Yeah, yeah, I don’t know if there’s anything planned, but I miss a summary—what happened? You hear things like the rich get richer and so on.

00:26:40 Facilitator Yes, there will be a conclusion. After this, we are supposed to be done by 4, and in about 5 min, there will be a conclusion where everything will be explained.

00:26:55 Speaker 1 I wonder if you could start the game on a smaller scale and then introduce challenges gradually, because when it started, I felt confused and frustrated, like, oh my god, how am I supposed to handle all this? Dividends, and remember this and that—it was so much that I almost couldn’t take it all in. If we had started on a smaller scale, maybe we could have adjusted it. And then, I also wonder if we could play it again in half a year and if it would have made any difference.

00:27:28 Speaker 4 Exactly.

00:27:31 Speaker 1 But I like the methodology, and I think it’s a fun way to tackle this kind of question. For adults, it’s fun, but also a learning experience, and it’s been interactive in a good way.

00:27:50 Speaker 5 Because something happens—one can feel that. You step into a role and face challenges that you wouldn’t normally encounter, and that's very educational, even if it's fictional; something still happens inside you.

The Woods Town discussion thus remain in the in-game aspect in this phase but moves somewhat between the personal perspective focusing on emotions such as frustration and the more holistic view on the benefits of the gaming format.

8. Discussion

Allowing the participants in a megagame to collectively shape a future in an open-ended way, stands out in relation to the majority of serious games that tend to reduce complexity in favour of transparency of cause-effect, and ability to measure progress towards given goals (e.g. Mayer, 2020; Serrano-Laguna et al., 2018). Instead, the megagame that provides the empirical basis for this study lacks a clear goal, except for the joint task to reach a climate neutral region with high quality of life. In the Switching the current games, participants had variety of backgrounds, ranging from high school student to energy company CEOs. In contrast to many other serious game-based approaches were participants typically come from homogenous groups, this kind of heterogeneity is a methodological strength when it comes to empowering perspective taking and anchoring the gaming experience in a variety of practices.

In the debriefings, a particular focus has been directed towards the participants' emotions, whether the experience in the game can be connected to their everyday life and new perspectives on the energy issue. The questions used are reflected in the four phases that we have addressed in the results and analysis section. It is worth noting that the discussions sometimes overlap and that the game format itself contributes to an experience where emotions are important, both to create commitment but also to understand and learn about a complex issue such as the energy system (Barrios-O'Neil & Hook, 2016). The value of also being able to relate to one's everyday life and to both challenge and confirm experiences is also something that bridges questions that are addressed in the various phases (Kriz, 2010).

Emotions are a common topic, present in the debriefings in different ways. First, participants experience frustration as they try to understand the mechanics of the game. However, there is a blurry boundary between frustration on how the megagame works and frustration stemming from the process of understanding the large web of relations with other roles that must be handled in order navigate the sought transformation. Some participants point to how the frustration shifts to the latter as the game proceeds. Here it becomes more of a positive emotion that is articulated to give a valuable experience of the real complexity of society as well as transformation. In some cases, participants also refer to the shift itself as valuable, arguing that it gave a sense of hope and collective action competence when they gradually realized how they could make things happen when working together.

The most common topic that appears in relation to the participants everyday life and what they learned is how difficult it is to communicate, coordinate and understand what the other participants were doing. This is particularly interesting as the participants themselves contributed to the complexity of the game through their own actions, and still struggled to understand the actions of others (Belton & Dillon, 2021). They reflect upon the difficulties to see the effects of actions taken in the game since, partly due to the time between action and effect, but also due to the impact of simultaneous actions taken by other players and news introduced as a part of the scenario.

As mentioned above, the debriefings from the two megagames presented in this article were comprised of participants that work close to energy and/or sustainability issues in their everyday lives. So, even if they did not encounter much new information, they stressed how they experienced the complexity of the energy system and how hard it is to transform when they must negotiate with many participants, especially when conditions change. A distinction is also visible between participants who focus on the technical side of the energy system and those who include broader social factors as well. This partially challenges the participants' ways of viewing and understanding the energy system, where some felt that the focus on energy issues was less than they had anticipated. For some, this was almost a disappointment, while for others, it served as a way to expand their understanding of the energy system and its complexity (Crookall, 2010). This has been a recurring experience in the debriefings we've included in this article as well as in others. This can also be tied back to the definition and understanding of the energy system that we have aimed for in the construction of the game—to view the energy system as a sociotechnical system, emphasizing the importance of how technical and social elements are integrated and interconnected. Although a simplification of reality, the megagame addresses several perspectives which might open for discussions about where to draw the relevant system-boundaries when dealing with system transformation.

8.1. Representing the dynamics of multi-party conversations through time-snaking

Analysing and presenting the outcome of the debriefing sessions proved challenging as we strived to reflect the complexity experienced by the participants as well as the dynamics of the discussions that took place during the debriefings. The time-snake approach makes it possible to present the overarching movements between central dimensions in the debriefing, reflecting the move from individual or detailed discussions to more holistic, in-the-world, discussions. While the process of coding transcribed discussions is inherently subjective, we controlled for this by comparing the coding of four different coders, aligning the positions of each 30 s segment when they diverged too much. A multi-party conversation is often signified by ambiguity that is hard to reflect according to two pre-defined dimensions. Given that the potential time-snake space consists of 400 positions, the codes where surprisingly similar in most cases. The results of our analysis show how participants move back and forth along the scale between detailed and holistic discussions, as well as between in-game and real-world reflections, as suggested in the debriefing methods proposed by Kriz (2010). This movement highlights how the game serves shared as experience for meaning making and collaborative learning. However, it also removes much of the finer details of the interactions that form the co-constructive process of the participants. However, we still believe that the approach provided additional value as it allowed us to compare the different debriefing sessions in a uniform manner. Further, the time-snake space depicts holistic aspects of multi-party conversation that usually are obscured in the micro-resolution of other methods such as conversation analysis. Other methods that aim to thematise or create models based on such data may be able to capture more overarching characteristics of the discussions, such themes, but still fail to show movements in the material, as in the case of the time-snake dimensions created for this particular purpose. Such changes are one of the characteristics of co-construction of meaning and understanding, as in the case of moving from discussing details in game to discussing real-world problems or shifts in system perspectives and levels.

8.2. Attuning complexity to allow for meaning making

Designing games that aim to reflect complex systems is challenging in the respect that in-game complexity must be representative of, but not necessarily as high as, the complexity of the target system. In the context of future studies this raises questions about how traceable cause and effect should be expected to be when deliberating possible futures and to what extent these must remain blurry. Also, a risk with quantifying the complex character of society is that it may be reduced to a single or a few parameters that must be managed. Too much complexity on the other hand risks the legitimacy of the game as providing relevant ground for discussions. Finding a level of complexity that is representative for the problem to be illustrated but still possible to gamify is thus a core challenge for the megagame designer. This design challenge also relates to the extent the game should be open and adaptable to creative initiatives not foreseen by the designers, the clearer cause-effect is the harder the game is to adapt in the moment.

This co-constructive process that takes place during the debriefing sessions is not the same as participants striving towards consensus, rather the opposite. Through appropriating multiple perspectives, the participants are better equipped to navigate real-world situations, even if those perspectives are contradictory. The end goal of debriefing is thus to gain a shared understanding of many different points of view instead of a singular narrative, and to be aware of the fact that descriptions of the same phenomena can look very different.

8.3. Future research

The debriefing sessions provide valuable insights into the participants experiences from participating in the Switching the Current megagame. However, these reflections are immediate reflections taking place in direct connection to the gaming event. It is therefore difficult to assess what the long-term effects of participating in a megagame like Switching the current will be. To investigate this, research projects could also conduct follow-up interviews with participants from gaming sessions, a few months after each game.

As for the time-snake method, it would be interesting to conduct additional analysis on similar game-based debriefings. The analysis focus on settings where participants discuss such in-game experience and how they connect to events and phenomena outside of the game, suggesting that the time-snake analysis can be used in a wide range of exercises, serious games, and simulation-based settings.

9. Conclusion

Transforming energy systems is among the most demanding aspects of reducing human impact on climate change. An energy system encompasses the production, consumption, and transmission of energy, and is tightly coupled to the energy market, which itself forms part of the wider economic system. As a result, producers and consumers are interconnected not only through technical infrastructures but also through financial mechanisms that are influenced by broader economic dynamics. Certain parts of the system, most notably the electricity grid, must remain continuously balanced; if production and demand deviate, even briefly, the system risks failing, with potentially severe consequences.

Moreover, the energy system involves not only institutional decision-makers but also the general population. Everyday choices made by individuals collectively shape how the system behaves. It is therefore essential to understand the energy system as a complex, adaptive socio-technical system. Yet this perspective is not always evident in common approaches used to raise awareness or support learning about climate change, such as simulation exercises or negotiation games. These activities often centre primarily on environmental aspects, sometimes incorporating economic or social dimensions, but rarely addressing all three simultaneously. This tendency likely stems from academic and organisational structures that separate disciplines and encourage researchers to focus on isolated components of the problem – an approach that stands in stark contrast to the deeply intertwined nature of energy systems, society, the environment, and the global climate.

Given its ability to connect people and comprise long time-scales, megagaming future energy systems serves as an important catalyst for nuanced discussions of possible futures. Here, debriefing sessions are a necessity to achieve reflection and perspective-taking beyond the immediate and messy game situation. Indeed, many times even scientific explanations of many of phenomena like climate change becomes irrelevant when considering coping with a complex, multi-stakeholder challenge that only can be understood when adapting several perspectives simultaneously.

Hence, we contribute to future studies, primarily by highlighting the potential in megagames by pointing to the mode of analyzing the debriefings as a time-snake that traces how the game experience informs co-construction of understandings of the complex energy-system. The time-snakes give quick visual feedback whether the debriefing discission has referred to out-of-game lessons learned based on in-game experiences from game play, and whether lessons learned are both discussed on a detailed or personal level, and on a general systemic level. A good debriefing session would be characterized by a time-snake that continuously moves back and forth between all areas in the figure, connecting game and real-work content. A time-snake analysis provides an additional tool for a debriefing team to reflect upon the quality of their debriefing and can help to improve the debriefing strategy for upcoming gaming sessions. We hope this will enhance future efforts to enhance deliberative discussions starting with a collective experience in a serious game. After all, simulation-games are renowned for enabling participants to explore possible futures, but as learning predominantly occurs in the debriefing session, the quality of the debriefing session determines the level of understanding of potential new futures which actually is realized.

To summarize, the main findings from our study are that:

Debriefing sessions are:

- Essential for achieving reflection and perspective-taking beyond the immediate game situation.
- A support for understanding of complex, multi-stakeholder challenges by integrating multiple perspectives.

The time-snake method was found to:

- Provide visual feedback to what extent debriefings connect in-game experiences to out-of-game lessons.
- Assess whether experiences are discussed both at personal/detailed and systemic/general levels.
- Help researchers to understand how the discussions were affected by the debriefing format, thereby …
- … supporting improvement of debriefing strategies for future games.

CRediT authorship contribution statement

Björn Johansson: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation. **Ann-Sofie Kall:** Writing – review & editing, Writing – original draft, Investigation, Conceptualization. **Ola Uhrqvist:** Writing – original draft, Visualization, Investigation, Conceptualization. **Joeri van Laere:** Writing – review & editing, Writing – original draft, Methodology, Investigation.

Data availability statement

Transcribed material (debriefing sessions) that support the findings (time-snake graphs) of this study are available on request from the corresponding author.

Declaration of the use of AI

The dictate function in Microsoft Office 365 was used to create initial transcriptions of the recorded material. These were then corrected by the authors before continued analysis, as described in the methods section.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Bjorn Johansson reports financial support was provided by Swedish Energy Agency. If there are other authors, they 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

The authors would like to thank the Swedish Energy Agency (grant number 2020-024506) for supporting this study.

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