Exploring water-society interaction: What can be learned at the interface of scenario analysis, integrated modelling, and policy gaming?

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1 Introduction

Sustainable water management requires insight in possible long-term developments of the water-society system. We hereby focus on non-linear development paths, generated by the interactions both between and within the water and society systems. To this end, we develop a scenario approach in which possible future developments of this water-society system are explored. Our scenario approach is based upon so-called *perspective-based scenario analysis* (Rotmans and de Vries 1997; Hoekstra 1998; Van Asselt et al. 2001; Middelkoop et al. 2004). With this method, future scenarios are developed along stereotypical perspectives on water management people may hold. We aim to extend this method, by exploring possible future societal perspective shifts and their implications for water management.

To represent the dynamics of such perspective shifts, we developed and applied a policy-game in which players compete over future water management policy. Following concepts of Cultural Theory (Thompson et al. 1990), Advocacy Coalition Framework theory (Sabatier and Jenkins-Smith 1993), and societal transitions (Rotmans 2005; Van der Brugge 2009), the game involves the formation and dynamical change of advocacy coalitions of players holding similar perspectives on water management. Shifts in perspective and / or relative power of the various coalitions – as driven by various scenario drivers and shock events incorporated in the game - are assumed representative of possible societal perspective shifts.

This approach draws from various methodological approaches. It draws from integrated scenario analysis through its overall ambition of exploring highly uncertain future developments, in particular from the approach of perspective based scenario-analysis. It draws also from integrated modelling. Players interact with an Integrated Assessment Meta Model (IAMM) of the water system, to explore the long-tem impacts of various drivers, and the consequences of adopted management strategies. Finally, it draws from policy gaming, as future shifts of perspectives and management strategies are explored in through a policy game. This approach - combining scenario analysis, modelling, and policy gaming - aims to generate new insights in the dynamics of societal change.

Previous research has focussed, amongst others, on a conceptual underpinning of the gaming approach (Valkering et al. 2009), mapping societal perspective change in the scenario analysis process (Offermans et al. 2009; Valkering et al. 2010), and the development of the IAMM (Haasnoot et al. 2009). Here, we further elaborate on representing the social dynamics of perspective change through the application of the policy-game. To this end, this paper contains:

1) Methodological background regarding scenario analysis, integrated modelling, and policy gaming,
2) A brief overview of the perspective-change scenario analysis approach,
3) The conceptual framework for analysing societal perspective shifts for the specific case of two perspective-based advocacy coalitions,
4) An application of this framework to a so-called ‘virtual’ case study on Dutch river management, involving various gaming sessions,
5) A summary of ‘lessons learned’, some ideas on how to move forward, and a reflection on the potential added value of the gaming approach vis-à-vis other methodological approaches.

2 Background

2.1 Scenario analysis

One approach for exploring water-society interaction is through scenario analysis. Scenario analysis is a means for structured thinking about the future (Rothman 2006). In this paper scenarios are defined as “coherent descriptions of alternative hypothetical futures that reflect different perspectives on past, present and future developments, which can serve as a basis for action” (Van Notten 2005). This definition reflects that scenarios are not predictions, but rather explorations of hypothetical futures, that they describe both an end-state as well as the trajectories leading to that state, and that the description should be coherent, meaning that causal relations are reflected in a valid way. The scenario descriptions can be qualitative (narrative) and /or quantitative, often containing a mix of both. Scenario analysis may serve a number of goals: to illuminate potential future problems, to explore policy alternatives in the face of uncertainty, to share understanding and concerns, to uncover and test assumptions, and to help identify choices and make decisions (Rothman 2006).

One of the main deficiencies in current scenario practice is the lack of unexpected ‘surprises’ in scenarios (Alcamo 2008). Toth (2008) discusses incorporating such surprise in relation to society-environment interactions. He argues that different types of surprises may be distinguished: *isolated surprises* (occurring in either one of the water or society subsystems without a significant impact on the other), *interactive surprises* (involving a causal relation between surprises in the water or society subsystems), and *propagating surprises* (involving a sequence of causal relations between surprises in the water or society subsystems). It is widely acknowledged that it is difficult to deal with these kinds of interactions in scenario studies. How society will respond to such surprises cannot be predicted, but whatever the response, its future trajectory will depend on it.

Summarizing, a main strength of scenario analysis is creating insight in a wide range of possible futures. However, a main challenge remains addressing surprises and discontinuous developments, especially in relation to highly uncertain societal responses.

2.2 Integrated Assessment modelling and ABM

A second approach for exploring water-society interaction is through Integrated Assessment modelling (IAM) and Agent-Based modelling (ABM). IAM is a modelling paradigm aimed at addressing complex problems of sustainable development. IAMs are typically computer models that aim to describe a societal subsystem 'as a whole', covering the environmental, social, economic, and institutional domains, and focussing on cause-effect relationships, feedbacks and adaptations (e.g. see Valkering 2009). To better represent social dynamics in integrated models, ABM may be used (Rotmans 1998; Rotmans 2006). In ABM, computer agents are programmed to represent social actors – individual people, organizations such as firms, or bodies such as nation states - reacting to each other, and to the computational environment in which they are located (Gilbert and Troitzsch 2005).

The gaming approach described in this paper is particularly related to integrated, agent-based models of structural societal change. These models aim to represent not only change of individual behaviour and collective policy amongst a group of actors, but also changes of structures and cultures at the societal level. A first example worth mentioning is the 'Battle of the Perspectives' model of (Janssen & de Vries, 1998), which models shifts of stereotype cultural perspectives in a heterogeneous population of agents coupled to an economy-energy-climate model. A second example is the recent transition model of (Bergman et al., 2008; Haxeltine et al., 2008; Schilperoord et al., 2008) developed in the Matisse project, which models societal change as an ongoing competition between a currently established *regime*, and emerging and competing *niches*, in response to *landscape changes*. Regimes and niches are represented as *collective agents,* supported (or no supported) by *individual agents*, with each agent holding particular behavioural strategies.

The strengths of these modelling approaches are that they present an analytical structure for understanding societal change, that they allow creating ensembles of simulation runs, and that the simulation models can operate as visualisation and discussion tools. A main weakness, however, is that simulation models of societal change are forceably incomplete in representing relevant processes underlying societal change. Nuances like emerging technological innovations, the occurence of extreme events, and societal responses to such events are difficult – if not impossible - to capture in a simulation tool. A main challenge is thus to find ways to include those nuances in the assessment of societal change, for example by applying these models in participatory processes with stakeholders.

2.3 Policy gaming

A third approach for exploring water-society interaction is through policy gaming. Simulation games can be defined as "experi(m)ent(i)al, rule-based, interactive environments, where players learn by taking actions and by experiencing their effects through feedback-mechanisms that are deliberately built into and around the game" (Mayer 2009). Bots and Van Daalen (2007) distinguish six typical functions of games for policy support reflected in corresponding metaphors:

- Research and analyse (game as a 'laboratory'): the game is used to investigate the aggregate result of the actions of people within system"
- Design and recommend (game as a 'design studio'): the game is used "to search for possible solutions for a […] policy problem"
- Strategic advice (game as a 'practice ring'): the game is used to assess – for a particular client – how "to nudge the policy process in a direction that is most favourable to him or her?"
- Mediation (game as a 'negotiation table'): the game is used "to resolve a conflict among two or more stakeholders"
- Democratisation ('consultative forum'): the game is used "to allow equal access to a [...] policy-making process for all stakeholders"
- Clarify values and arguments ('parliament'): the game is used "to clarify the values and arguments behind different points of view"

At the interface of modelling and gaming, the concept of participatory agent-based modelling is particularly relevant. Participatory ABM - also referred to as 'companion modelling' (Barreteau, 2003), or 'participatory Agent-Based Social Simulation' (Ramanath & Gilbert, 2004) – involves applying ABMs in a participatory process with stakeholders. Stakeholders are thus confronted with model representations of their own behaviour, and are stimulated to improve their representations in collaboration with the research team. The virtue this approach is combining the function of gaming as a 'laboratory' with the various other functions aimed at process support.

Strong features of policy-gaming and participatory ABM include a rather in-depth understanding of multi-stakeholder dynamics, in combination with various functions of policy support and learning. However, policy gaming applications so far tend to focus on relatively local case studies, in which a limited set of stakeholders and well-defined management issues allow for a detailed study of specific agent-interactions. A main challenge is thus to 'upscale' this approach to reflect perspective changes at the societal level over the long term.

3 Methodology

3.1 Scenario analysis of perspective change

Our methodology for exploring complex water-society dynamics combines aspects of the above mentioned approaches. It notably builds upon so-called *perspective-based scenario analysis* (Rotmans and de Vries 1997; Hoekstra 1998; Van Asselt, Middelkoop et al. 2001; Middelkoop, Van Asselt et al. 2004). In perspective-based scenario analysis, Cultural Theory (Thompson, Ellis et al. 1990) is used to map out different stereotype worldviews and management styles. Different combinations of worldviews and management styles then generate different images of the future which are further analysed in terms of their desirability, creating insight in the robustness off the various management styles. In scenario analysis of *perspective change* (Valkering, Van der Brugge et al. 2010) this approach is elaborated further by:1) drawing from 'real-world' societal perspectives rather than stereotypical perspectives, and 2) including the dynamics that may eventually lead to societal perspective change. This approach is considered useful to assess social robustness of strategies for river management (Offermans, Haasnoot et al. 2009), and to explore river management adaptation paths (Haasnoot, Middelkoop et al. 2009).

The analytical framework underlying the approach is displayed in Figure 1. The framework frames water-society interaction as the interaction between a water system (e.g. the water system of the Netherlands) and a societal response. This interaction is driven by context developments where we distinguish general Social, Technological, Economic, Environmental and Political (STEEP) developments, and transient climate change scenarios that reflect gradually changing weather patterns up till the year 2100. In practice, the water system is modelled with an IAMM (Haasnoot, Middelkoop et al. 2009), the STEEP scenarios are presented in the form of newspaper headlines, and the climate change scenarios enter as realisations of a weather generator and a hydrological rainfall-runoff model. The societal response model, finally, is represented through the perspective based policy-game further described in this paper.

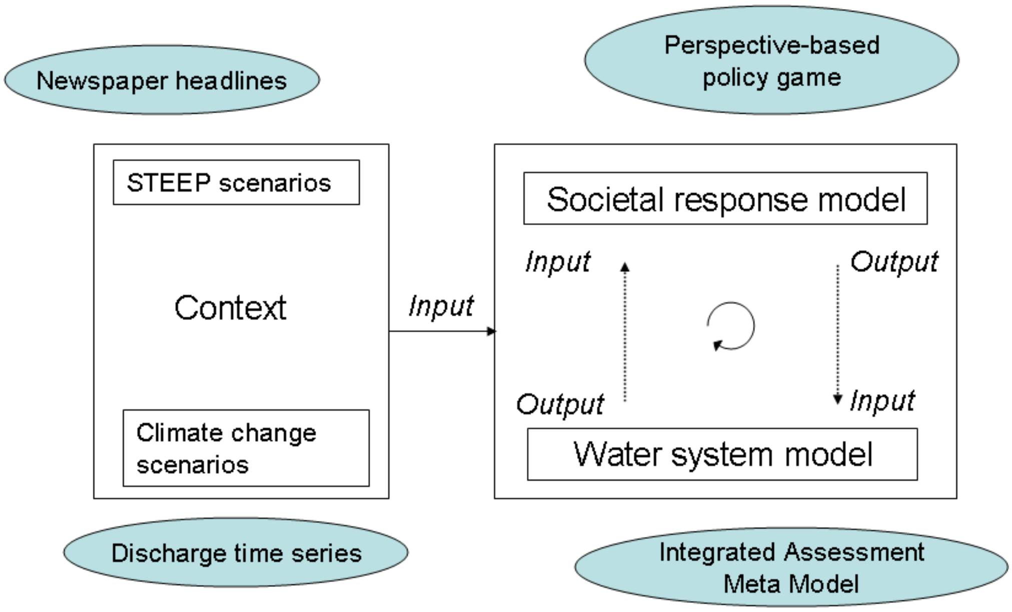

Figure 1: analytical framework representing water-society interaction

The societal response model benefits from the approach of *perspectives mapping* (Offermans, Haasnoot et al. 2009; Valkering, Van der Brugge et al. 2010). The perspectives map (see Figure 2) consists of a set of *salient beliefs* pertaining to world view and management style. For each belief, the hierarchist, individualist and egalitarian position is given. Regarding the management of flood safety, for example, the hierarchist believes in the principle of flood prevention, the egalitarian believes flood prone areas should be abandoned, while the individualist would favour innovative solutions for flood resistant building in flood prone areas. The perspective of any societal actor is then mapped by deciding for each one of the salient beliefs whether it supports the hierarchist, egalitarian, or individualist view (or perhaps multiple or none of those). The perspectives map was implemented in a simple computer tool. The average position on the perspectives map is then visualized in the perspectives landscape of Figure 4. Changes in salient beliefs are assumed to be driven by an accumulation of *surprises*, defined as an event or development that is inconsistent with ones own world view (Thompson, Ellis et al. 1990). Surprises are typically related to events and developments in the context and the water system model, see Figure 1.

WATERVIEW	**Water function priority**	Nature and space	Discharge of water	Prosperity
	Trust in technology	Positive but reserved	Great trust	Low
	Climate change	Minimal trend	Extreme trend	Average trend
	Economic context	Average trend	Weak growth	Strong growth
	Safety	Adaptation and innovation	Avoiding flood prone areas	Flood prevention
	Principle of spatial planning	Water follows	Water steers	Water offers opportunities
	Responsibility	Society	Government	Private
	Decision-making process	Norms and expert knowledge	Market and privatization	Participatory

Figure 2: The perspectives map for Dutch river management. The perspectives map consists of a set of salient beliefs (the rows) regarding, for example, the value of water, trust in technological solutions, the priority given to water functions, the main principle of water management and spatial panning, and the way the water management process should be carried out. For each belief, the hierarchist, individualist and egalitarian positions (columns - in random order) are given. The current map shows the position of a perspective based coalition during one of the simulation runs.

3.2 Social dynamics of perspective change

Here, we further elaborate on the social dynamics of perspective change as represented by the societal response model. A particularly useful approach for understanding such social responses is the Advocacy Coalition Framework (ACF) (Sabatier and Jenkins-Smith 1993). This theory is particularly useful, since – in contrast to other policy theories – it 1) describes policy change over the long term (a decade or more), 2) considers multiple actors involving both public and private organizations, 3) considers actors at multiple levels of government, and 4) it conceptualizes the policy process on the basis of belief systems similar to the ones that Cultural Theory describes. In the ACF, a policy subsystem is defined as the set of actors dealing with a policy problem. These actors - referred to as ‘policy elites’ - may hold various positions, such as public official, interest group leaders, and researchers. Policy actors that share a particular set of beliefs are assumed to form coalitions that advocate certain policy strategies. The policy process is then modelled as a competition among the advocacy coalitions whose relative strengths may vary over time.

The ACF thus shows how in a society multiple competing coalitions reflecting different perspectives may co-exist. Following transition theory (Rotmans 2005; Van der Brugge 2009) one may discriminate between dominant perspectives and less dominant perspectives, called ‘undercurrents’. The dominant perspective is understood as the perspective that receives the largest societal support. An undercurrent is seen as a distinguishable ‘social movement’ - possibly linked to specific individuals, organizations, and networks - which clearly advocates a different perspective then the dominant one. Undercurrents may exist for a long time while hardly being noticed. However, appropriate ‘surprises’ may form the breeding ground for undercurrents to grow and eventually replace the dominant perspective.

These theoretical insights lay the basis for multiple-perspective based gaming as a way to model the social dynamics of societal perspective change. Multiple-perspective based gaming (Valkering, Tàbara et al. 2009) entails setting up a policy-gaming environment in which players advocating different perspectives compete over water management policy. The game allows for the formation of perspective based coalitions representing dominant perspectives and undercurrents. This is assumed to be a highly dynamic process, in which the positions and / or relative power of the various coalition perspectives are constantly subject to change in response to surprising evens and developments in the context and the water system, see Figure 1. Playing the game will generate one possible storyline of water-society interaction. The observed game dynamics between the dominant perspective and undercurrent coalitions is assumed to generate insight in the social dynamics of perspective change.

3.3 Conceptual framework for analysing societal perspective change

During the game, three aspects are monitored: a) the river management measures taken by the coalitions; b) the changes in the perspectives of the coalition by using the perspectives map and c) the motivations of measures and perspectives changes. By plotting the perspectives of the coalitions on the so-called ‘perspectives landscape’ of Figure 4 we can track their positions during the course of the game as a pathway through the perspectives landscape. These pathways can be related to the developments and events occurring in the game, and the motivations underlying the various perspective changes given by the game players.

In order to further clarify the social dynamics of societal perspective change, we propose an analysis framework that highlights two relative dimensions of coalitions for the simple case of a game with only two coalitions:

- The first dimension is *dominance*. Dominance represents the extent to which one of the two coalitions is dominant over the other. High dominance implies that one perspective is clearly dominant over the other, allowing the dominant perspective to operate rather independently from the undercurrent one. Low dominance means that different perspectives receive equal support, implying that they are mutually dependent for implementing water management policy.
- The second dimension is *agreement*. Agreement represents the extent to which the coalition perspectives overlap. Much agreement means that the coalitions are rather close to each other and can be assumed cooperative (‘policy oriented learning’). Disagreement means that the will be further apart and probably rather conflictive (‘dialogue of the deaf’).

The two dimensions *dominance* and *agreement* generate a ‘phase space’ with four distinguishable system states, see Figure 3:

- The upper right quadrant (agreement high – dominance high) is referred to as ‘Influence’). This state constitutes a large and a small coalition that show only a small difference in viewpoints. It is assumed that the smaller coalition will aim to influence the larger one on minor accounts, without any radical points of critique.

- The upper left quadrant (agreement high – dominance low) is referred to as 'Compromise'. This state reflects strong similarity and equal dominance amongst the coalitions. It is assumed that coalitions will easily find common ground to implement a mutually supported river management plan.
- The lower left quadrant (agreement low – dominance low) is referred to as 'Deadlock'. In this state, two coalitions of diverging ideas are balanced in power. It is assumed that neither of the coalitions can implement their viewpoint without the consent of the other. Hence, negotiation is required.
- The lower right quadrant (agreement low – dominance high) is referred to as 'Criticaster'. This state constitutes a large and a small coalition with a large difference in viewpoints. It is assumed that the larger coalition can implement their view independently. The smaller coalition, however, will (very) critically reflect on their position. The larger coalition is free to take this critique into account or not.

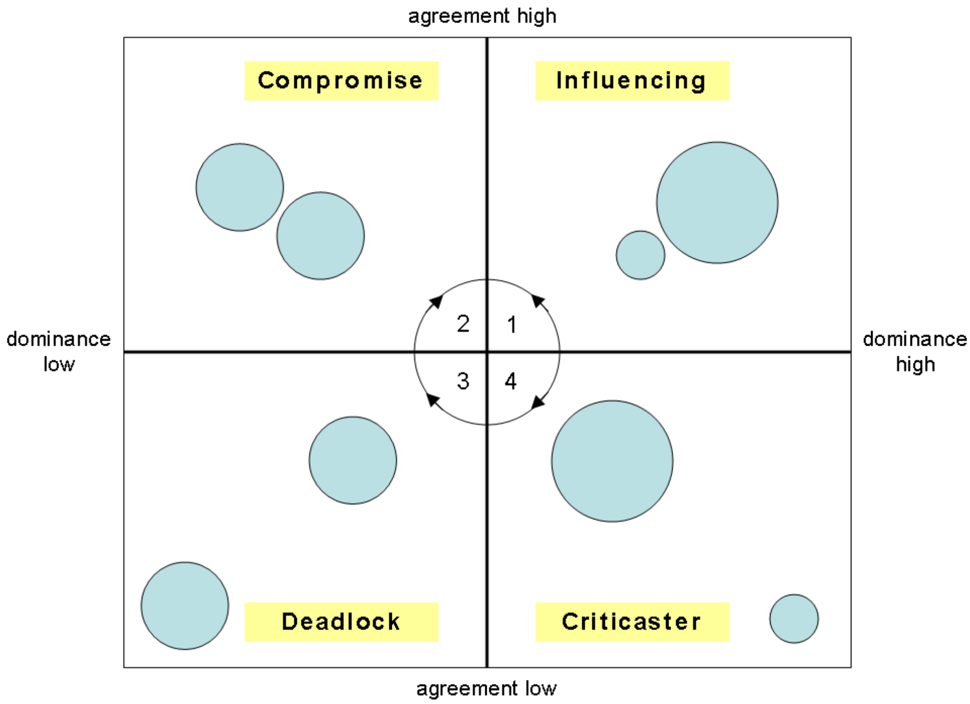

Figure 3: The co-development of two coalitions is mapped as trajectories in a phase space generated by the dimensions of *dominance* and *agreement*

The co-development of the two coalitions is then mapped as trajectories in the phase space of Figure 3. Reflecting on this figure, one may distinguish eight 'state transitions' where the system moves from one state to the other as a result of a change on one of the system's dimensions. A trajectory is then interpreted as a sequence of individual state transitions. Hereby, the system may display for example 'left-turning' cycles (e.g. state transitions 1→2→3→4), 'right-turning' cycles (e.g. state transitions 4→3→2→1), or 'oscillations' (e.g. state transitions 1→2→1→2).

As an example we reflect on the historic development of perspectives on Dutch water management. In a paper presented at this conference, Offermans and Valkering (2010) argue that pollution and environmental scandals in the 1960s, 1970s and 1980s nourished the egalitarian undercurrent, making the dominant perspective shift to an egalitarian direction. This suggests the system moved from the 'Criticaster' state to a state of 'Influence', i.e. a transition path 4→1.[1]

4 Results of a virtual case

The gaming approach was applied in a so-called 'virtual case' involving a virtual river stretch representative for many Dutch rivers in the Netherlands. A number of gaming sessions were organised with different groups of players: a mixed group of scientists and water managers of the project's advisory board, water managers of the Dutch 'Water service', scientists of Twente University, and a group of scientists and water managers at an international conference on deltas in times of climate change[2]. The aim of these sessions was notably to test the gaming approach, and methodological learning in view of an upcoming 'real' case study.

The process design can be summarized as:

Step 0:	Introduction to the gaming approach and water management context
Step 1:	Individual perspectives mapping
Step 2:	Coalition forming; grouping of people with (presumably) similar perspectives on water management
Step 3:	Formulation of a 'white paper' including a concrete proposal for a water management strategy and the underlying motivation
Step 4:	Negotiation (only in case of 'Deadlock' or 'Cooperation') during which the two coalitions are obliged to agree on a common water management strategy
Step 5:	Implementation of the water management strategy in the water system model and presentation of the results.
Step 6:	Presentation of context developments in the form of newspaper headlines
Step 7:	Return to step 2 and repeat the cycle.

During the gaming sessions, the Integrated Assessment Meta Model was operated by a member of the research team to assess the impacts of the chosen water management

[1] Yet, it is not fully understood if perspectives change because dominant groups change perspectives, or because the societal support among groups changes (or maybe a combination of both). In other words, the transition path might also be described with a transition path 4→3→2. Further research would be required to better interpret such historic perspective changes in terms of shifts in dominance and agreement amongst competing advocacy coalitions.

[2] 'Deltas in Times of Climate Change', Rotterdam, the Netherlands, 29 September - 1 October 2010

strategies under given climate scenarios. Players were not asked to reflect explicitly on the perspectives map. The perspective changes of the coalitions were recorded through observations of the statements made interpreted on the perspectives map by a project-team member. Finally, the participants were stimulated to reconsider the coalition by appointing so-called ‘recruiters’ with the explicit aim to convince members of the other coalition to join theirs.

The gaming sessions resulted in a number of possible future trajectories of 2-coalition perspective change. Figure 4 presents one such trajectory on the perspectives triangle. This particular storyline shows ‘red’ and ‘blue’ coalitions that are initially in agreement. Under various events and developments – like floods in the water system at hand, and water quality issues in an adjacent country - the blue coalition gradually shifts in the direction of the egalitarian perspective. Figure 5 presents all four trajectories on the phase space described above. Note that dominance is constant in all trajectories. Individual players were very hesitant to shift coalitions, once they felt committed to their ‘team’. Agreement does change on minor accounts. In one case sufficient to move from the ‘Compromising’ to the ‘Deadlock’ stage. Nonetheless, observed perspective and coalition dynamics so far are not considered ‘extreme’.

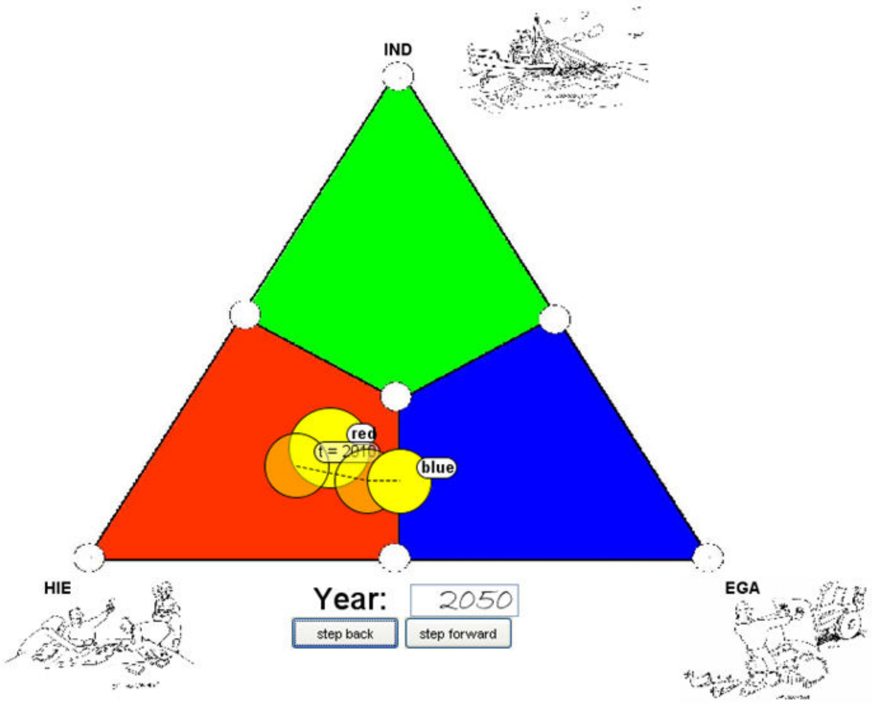

Figure 4: Co-development of two coalitions mapped on the perspectives landscape in which the corner points of the triangle represent the stereotype cultural perspectives. The main perspective of the two coalitions ‘red’ and ‘blue’ are plotted in the triangle, showing that they are a mix of EGA, IND or HIE beliefs. The figure illustrates the pathway for one particular gaming simulation run of the virtual case.

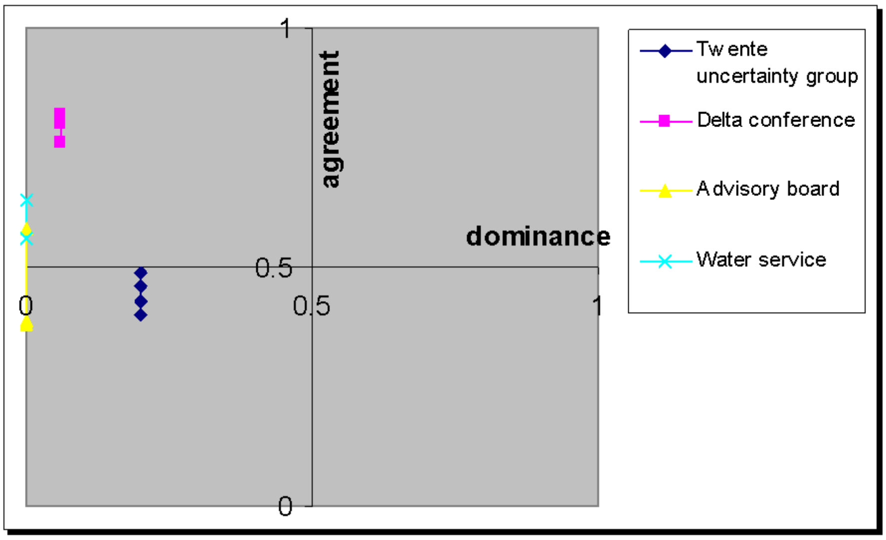

Figure 5: Co-development of two coalitions mapped on the dominance-agreement phase space. The figure shows all four gaming simulation runs of the virtual case.

5 Discussion & conclusion

The main goal of this paper is to report on the way we are dealing with water-society interaction in scenario analysis. To this end, we elaborated on the perspective-based scenario analysis and introduced an innovative feature; policy-gaming as a way to represent societal perspective change. This feature gives the opportunity to generate what we might call *iteration scenarios*. These scenarios are generated by iterations between the social system on the one hand, and the water system on the other. In theory, this type of scenarios can therefore by highly non-linear and turbulent. So, to what extent did we succeed in these ambitions?

5.1 Methodological lessons

First, we list a number of main observations regarding the games dynamics and the extent to which these represent societal dynamics in a valid way. These are based on both reflection of game participants and the project-team:

Multiple dynamics: In its current form, the water management game involves different types of the dynamics. First, it involves the dynamics of *water-society interaction*; players formulating water management strategies, being confronted with the results f their choices, consequently reformulating their management strategies. This allows for exploring adaptation pathways, focussing on the societal costs of possible shifts in management style, the irreversibility of certain changes made, the need for no-regret options, and so on. Second, it includes the dynamics of *perspective change* and the way these are related to various events and developments occurring in the game. Third, it includes the *coalition dynamics*; the way societal actors interact, how advocacy coalitions may rise and fall, and how this may eventually lead to a shift in management style at the societal level. The virtue of this approach is that it allows for a rich representation of societal change, and an understanding of how these different types of dynamics may relate. The drawback, however, is that it makes the game rather complicated to play. This calls for a clearer definition of the goal of the game, as a tool to generate insight on water society interaction and societal change. Probably, 'sub-versions' of the game are necessary to be able to focus on different types of dynamics in relative isolation, with a comprehensive game version to be played only be experienced players.

Coalition dynamics: The current approach was found to be inadequate to simulate the dominance-dimension of the coalition dynamics. It was assumed that individual players would be triggered to change coalition when they found the other coalition better corresponded with their own beliefs. In reality, however, individual players were loyal to their initial coalition, considering changing coalitions as a way of loosing. This calls for a different form of implementing coalition dynamics in which commitment to a coalition is less dominant. Possibly, the goal of the game should be formulated such that individual players are triggered to change coalitions as a strategy to win the game.

Measuring perspective change: To analyse perspective change trajectories, monitoring perspective changes during the game sessions is of vital importance. Two options are explored: observation and interpretation, and a direct mapping of perspective change by the advocacy coalitions on the perspectives map. Although observation and interpretation allows for a better flow of the game dynamics, it remains relatively subjective and practically requires the availability of observers. Therefore, direct mapping is considered more suitably, and is implemented in an explicit reflection of the coalition's perspectives as part of their whitepaper (i.e. in step 3 of the game process design).

5.2 Understanding water-society interactions

An upcoming challenge is to find ways in which observations from individual gaming sessions are aggregated to generic insights on water-society interaction and societal change. Three approaches can be considered:

Finding patterns: After playing the game many times, certain patterns might be deduced from both the perspective change and the dominance-agreement frameworks. Possible patterns – for example – might include linear trajectories, step-wise shifts, cyclical patterns, oscillating patterns, and patterns of various shapes (square, triangle, V-shaped). The challenge, then, is to find generic insights on the context under which certain patterns do – or do not - occur. This approach relies upon playing many sessions with different STEEP and climate scenarios as input, as well as surprising events that randomly enter the game.

Hypothesis testing: This would involve the continuous formulation and testing of hypothesis. Examples might be 'A single flood event followed by a prolonged period of drought will cause a perspective shift to the egalitarian regime' or 'In the 'Criticaster' stage, surprises to the dominant perspective will trigger a transition to 'Deadlock'. This approach relies thus on a careful formulation of hypothesis, and design of specific game sessions – i.e. the selection of surprising events and developments - to test the specific hypothesis formulated.

Exploring transitions: This would involve the formulation of desirable end-states prior to the game sessions (Tàbara and Haxeltine 2008). In the game itself one would then explore the conditions under which these end-states might be reached. Although this approach is clearly normative – presupposing some desired sustainability transition - it will equally generate 'value-free' insights in the dynamics of water-society interaction and societal change.

5.3 Conclusion

This approach - combining scenario analysis, modelling, and policy gaming - aims to generate new insights in the dynamics of societal change. This may include a better understanding of its main drivers, and the assessment of thresholds (e.g. with respect to the level of climate change or spatial pressure) at which fundamental shifts (societal transitions) may occur. It potentially combines the strengths of the various methodological pillars: creating insight in a wide range of possible future, providing an analytical structure for understanding societal change, an in-depth understanding of multi-stakeholder dynamics, possibly in combination with various functions of process support and learning.

However, many challenges exist for translating the concept into a working, useful, and enjoyable game. These include incorporating different types of dynamics into a manageable game format, representing changes in the coalition strengths, mapping perspective changes as part of the gaming process, and finding ways in which observations from individual gaming sessions are aggregated to generic insights on water-society interaction and societal change.

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