Developing 'playable metagames' for participatory stakeholder analysis

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1 Introduction

If public policy making is viewed as a negotiation process, the complexity of this process will increase roughly in proportion with the number of stakeholders involved, the variety of their interests, the variety of available options, and the time frame within which decisions are to be made. The complexity of the negotiation process also depends on the extent to which information on each of these factors is available to the stakeholders. If stakeholders know each other's means and ends, and if these means and ends remain the same for a certain time span, the negotiation is like a puzzle for which some optimal solution can be found. But if the problem is rife with uncertainties and hidden objectives, stakeholders will play strategic 'games' that may produce unforeseen, unintended and undesirable, but very real effects.

The general purpose of stakeholder analysis (Freeman 1984; Donaldson and Preston 1995) is to gain such insight in a policy problem that stakeholder strategies can be anticipated and evaluated in terms of the negotiation process and its outcome. If the analysis is transparent and authoritative, it may pre-empt detrimental strategic behaviour. Analysis of stakeholders, therefore, can make an important contribution to public policy making.

The idea to investigate *participatory* stakeholder analysis finds its roots in the developments in participatory policy analysis and planning (Durning 1993; Mayer 1997), which emphasises the functional role of discourse and learning in these processes. Active stakeholder participation in the analysis of ill-structured problems is seen to enhance both the substantive quality (scope of the analysis, use of available knowledge) and the procedural quality (mutual understanding, trust, willingness to act) of the problem solving process. This view might also apply to analysis of stakeholders.

While searching the literature for a method for stakeholder analysis that might be used in a participatory mode, we came across *metagame* theory (Howard 1971). As the name suggests, the metagame approach involves framing a situation as a

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strategic game in which stakeholders try to realise their objectives by means of the options available to them. The subsequent meta-analysis of this game gives insight in possible strategies and their outcome. Metagame theory provides a well-researched conceptual framework for analysis that has found practical application in public policy.

To investigate whether metagame theory can be operationalised in a participatory method for stakeholder analysis, we have developed the concept of '*playable* metagames' in the context of a professional training programme, and subsequently field-tested it in a case of water resources management in Egypt (Hermans et al. 2002, Hermans and Bots 2003).

In this paper, we focus on the development of 'playable metagames'. We start out by reviewing the basics of metagame theory and showing its potential as an interactive gaming-simulation method. Next, we present the case of industrial chlorine transport that we used to develop the 'playable metagame' concept, discuss its metagame model, and describe its practical implementation as an interactive game. We then report our experiences with 'playable metagames' to date, and we end by drawing some more general conclusions.

2 A primer on metagame theory: Analysis of Options

Metagame theory was presented by Howard in the 1960s as a reconstruction of game theory on a non-quantitative basis (Howard 1971, p. xi). Metagame analysis reflects on a problem in terms of decision issues, and stakeholders who may exert different options to gain control over these issues. The analysis reveals what likely scenarios exist, and who has the power to control the course of events. The practical application of metagame theory is based on the analysis of options method, first applied to study problems like the strategic arms race and nuclear proliferation (Howard 1971, 1989).

The analysis of options method typically starts with the following three steps:

1. Review the *issues* to be decided.
2. Ask *who controls* the issues, either directly or indirectly.
3. Ask how the stakeholders control the issues, resulting in an inventory of policy *options*.

The dependencies between options also have to be formulated, e.g. "option X can only be implemented if option Y is also implemented", or "options Y and Z are mutually exclusive". Full elaboration of these three steps provides a metagame model, which can then be analysed in different ways.

The possible outcomes of the game, based on the combination of options, are called *scenarios*. In theory, a game with N stakeholders s_1, ..., s_N who have O_i options (i = 1, ..., N), there are $O_1 \times ... \times O_N$ possible outcomes. Large numbers of stakeholders and options will obviously cause a combinatorial explosion, but the dependencies between options will reduce the number of scenarios, because they rule out those containing logically or physically impossible combinations of options. Further analysis of the scenarios results in a 'strategic map' that reveals how stakeholders can use their power to move from one scenario to another, and which moves are likely to occur in view of the stakeholders' preferences.

3 Playable metagames

Since its first presentation by Howard, metagame theory has been used by different researchers and has inspired several new developments. Its framework has been used to study strategic conflict (Fraser and Hipel 1980) and it has been extended to include different perspectives of stakeholders in modelling a conflict by means of 'hypergame analysis' (Bennett et al. 1989). All of these studies view metagaming as a method to be used by *analysts*, they emphasise the *meta* aspect, i.e., the mathematical analysis of the metagame model.

To use metagame theory as the basis for participatory stakeholder analysis, the *gaming* aspect must be developed much further. The metagame should become a vehicle for learning for the participants, much more than a tool for the analyst. By playing a metagame, i.e., by genuinely trying to 'win' by trying to convince opponents to move over to one's own position, by hearing the others' arguments, by seeing them shift or stay put, and by experimenting with novel, possibly even deceitful strategies, stakeholders will learn in two different dimensions: the substantive-strategic dimension (understanding the problem) and the social dimension (understanding the other stakeholders' personalities). Actually playing a metagame is also expected to enhance the emotional involvement of the participants and their receptiveness for the 'lessons' drawn from the game using the meta-analysis in the debriefing (Petty et al. 1981).

Developing a playable metagame requires that, once the analysis of options has been performed, careful attention must be given to the selection of players, the social setting for their interaction, the rules of the game, and the debriefing.

1. The *players* enact the negotiations between the stakeholders. They assume the role of one stakeholder, using a role script containing the information on this stakeholder's interests and resources. Role scripts must be realistic without becoming too detailed. They should be consistent with the structure of the metagame, and yet allow players sufficient freedom to incorporate their own views.
2. The *social setting* can be configured in different ways, depending on the complexity of the game, in particular the number of players, and the time that is available for playing. In its simplest form, the players sit around a table and openly exchange their views. To enhance the strategic element of the game, players can be allowed to conduct bilateral talks.
3. The *rules of the game* must define how the game proceeds and when the game ends. Typically, the game will be organised in several rounds. Each round, players can interact, either freely or constrained by procedural rules, and at the end of a round they make their preferred option known to the game director. The interactive metagame ends when a subset of the players reaches agreement on a feasible scenario, or when a pre-set number of rounds has been played.

4. The *debriefing* should focus on participant learning, rather than ex-post data collection by the analyst. It should stimulate the players to reflect on their initial perception of the situation, the sequence of events during the game, and the realism of the negotiations and the resulting scenario. There should be room to criticise the game, e.g. for being too simple or biased to the interest of certain stakeholders, but one should guard against dismissal of the game for being unrealistic. Critical remarks about the game should be used as starting points for ‘what if’-type discussions: “How would the scenario have been if such-and-so had been different?”

To be interesting for the participants, the metagame model should have a range of feasible scenarios, or its outcome will be too obvious. Moreover, there must be a clear incentive for the players to negotiate, which means that the *Status Quo* scenario (Howard 1989, pp. 243 *ff*) should be undesirable for a number of stakeholders. The social setting and the rules of the game should enforce each other. Playability can be enhanced by providing pre-printed forms, time tables, and memory aides to the players.

4 The Industrial Chlorine Transport metagame

The metagame presented in this paper was developed for a course on public policy making as part of a master’s programme in Safety, Health and the Environment. The underlying case study on chlorine transport for the fictitious Polymer Engineering Company Holland (PECH) was used throughout this course, which also covered risk analysis, environmental impact assessment, and multi-criteria decision analysis. The problem setting revolves around PECH, who wish to increase their production capacity for polyvinyl chloride (PVC). The other stakeholders involved are:

- Chlorosell, located at approximately 200 km from PECH, who produces the highly toxic chlorine gas that is used in the production of PVC
- RailCo, the railroad company who transports the chlorine from Chlorosell to PECH
- the state government, who regulates industrial activities and infrastructure development
- the citizens, who may benefit from investments in the area but also face the risk of accidents that may occur with chlorine transports.

There are three generic scenarios to meet the increased demand for chlorine:

1. *Increase transport capacity by train*. In the current situation, PECH is supplied with chlorine by train. The supply can be increased either by extending the trains or by increasing the frequency of the train transports. Neither option requires a new license from the government, since RailCo is allowed to transport chlorine over the existing railway track. However, to accommodate longer trains, PECH must invest in expensive storage facilities since its current facili-

ties make it illegal for PECH to stock more chlorine on its site. On the other hand, opting for more frequent trains may render PECH more vulnerable to activism by the anti-chlorine lobby that recently has been gaining support.

2. *Construct a pipeline*. A sunk-in pipeline will guarantee a continuous and efficient supply of chlorine, but requires high capital investments and at least three years of construction time. On the other hand, the cost can be shared between PECH and Chlorosell. There are two possible tracks for a pipeline: one following the existing railway tracks (pipeline A), which is cheaper to construct but runs through densely inhabited areas, and one that avoids these areas (pipeline B) but is more expensive. Both tracks require government permission.
3. *Produce chlorine on-site.* By constructing a chlorine production plant on its own grounds, PECH can ensure a steady supply of chlorine independently of Chlorosell and RailCo. But there are drawbacks as well: the required capital investment must be born by PECH alone, the construction will take about two years time, and a special permit must be obtained from the state government.

The zero option of PECH is to give up its expansion plans and continue its present production using trains as usual for the supply of chlorine. Each scenario will affect the interests of several stakeholders. Moreover, any chosen policy can only be implemented successfully when several stakeholders cooperate:

- RailCo is involved in the first generic scenario. More or longer trains would increase RailCo's income from freight transportation, but an accident during a chlorine transport would have dramatic consequences for RailCo, especially with longer trains that contain more chlorine. If PECH and Chlorosell agree to invest in a pipeline, or if PECH decides to construct an on-site chlorine plant, RailCo loses its revenues from the chlorine transports.
- The state government is involved in the second and third generic scenario because an official permit is required for the construction of a chlorine plant or a pipeline. Government can decide to simply grant these permits or it can decide to grant these permits with some additional constraints, defining additional measures that should be taken to improve the safety of the construction. Thus, permits with constraints are likely to reduce risks, but to increase costs (which might have adverse impacts on the regional economy). For the options that involve trains, no government permits are presently required.
- The citizens hold a stake in all generic scenarios, because the chlorine transport will impact their safety and the value of their houses. Although they have no formal decision making power, citizens can organize anti-train actions if other stakeholders decide to continue or increase the transportation of chlorine by rail. These anti-train actions can delay railway transportation, as it will be relatively easy to (anonymously) damage railway infrastructure. If a chlorine plant or a pipeline is opted for, citizens can start legal procedures which will put pressure on government to withdraw the permits or to change simple permits into permits with constraints.

A complete overview of the stakeholder options is shown in Table 1. Of the theoretical 6×5×6×4×4 = 2880 possible combinations, only 18 constitute a feasible scenario. These are shown in Table 2.

Table 1. Actors and their options

Actors and options (coded using initials)			
PECH		*Chlorosell*	
Pcp	Construct chlorine plant	Clt	Longer trains
Plt	Longer trains	Cmft	More frequent trains
Pmft	More frequent trains	Cnt	No trains
PplA	Construct pipeline A	CplA	Construct pipeline A
PplB	Construct pipeline B	CplB	Construct pipeline B
Ptau	Trains as usual	Ctau	Trains as usual
RailCo		*Citizens*	
Rlt	Longer trains	Zata	Anti-train actions
Rmft	More frequent trains	Zkq	Keep quiet
Rnt	No trains	Zpcp	Dispute permit for chlorine plant
Rtau	Trains as usual	Zppl	Dispute permit for pipeline
Government			
Gcp	Permit chlorine plant		
Gcpc	Permit chlorine plant with constraints		
Gni	No intervention		
Gpl	Permit pipeline		
Gplc	Permit pipeline with constraints		

Table 2. Feasible scenarios

Scenario	**Chlorosell**	**Government**	**PECH**	**RailCo**	**Citizens**
1 / 2	CplA	Gpl	PplA	Rnt	Zppl / Zkq
3 / 4	CplA	Gplc	PplA	Rnt	Zppl / Zkq
5 / 6	CplB	Gpl	PplB	Rnt	Zppl / Zkq
7 / 8	CplB	Gplc	PplB	Rnt	Zppl / Zkq
9 / 10	Cmft	Gni	Pmft	Rmft	Zata / Zkq
11 / 12	Clt	Gni	Plt	Rlt	Zata / Zkq
13 / 14	Ctau	Gni	Ptau	Rtau	Zata / Zkq
15 / 16	Cnt	Gcp	Pcp	Rnt	Zpcp / Zkq
17 / 18	Cnt	Gcpc	Pcp	Rnt	Zpcp / Zkq

The stakeholder moves can be presented graphically in a strategic map like the one in Figure 1. This particular map shows that PECH, RailCo and the state government are the most influential stakeholders because they can direct the game from one generic scenario to another, but no single stakeholder can force a specific outcome: PECH can decide to construct an on-site chlorine plant without the consent of Chlorosell, RailCo or the citizens, but still requires permission from government. RailCo can decide to cease its train transport altogether, and Chlorosell can decide to cease its deliveries to PECH, but in both (unlikely) cases the other stakeholders are still in the position to agree on some other option for chlorine supply. By granting or withholding permits, the state government can steer the negotiations towards any of the three generic scenarios, but it cannot prevent the train scenarios.

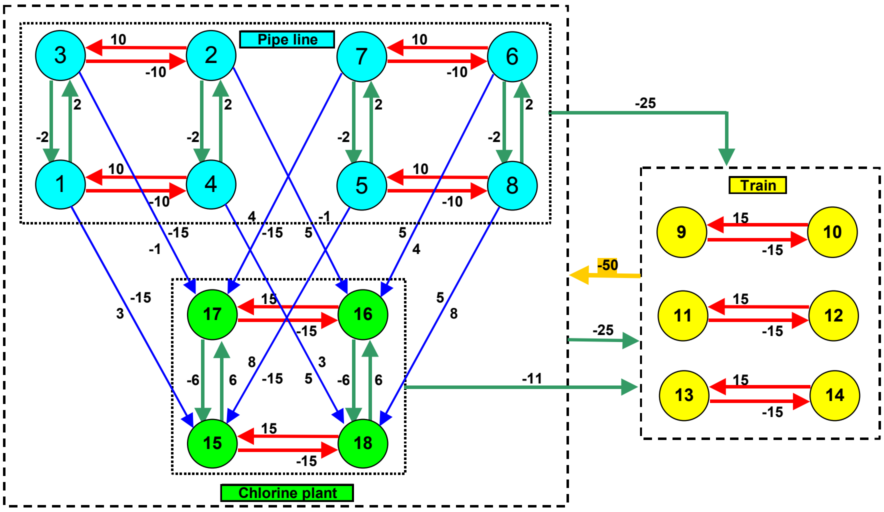

Fig. 1. Strategic map showing feasible scenarios and moves of stakeholders

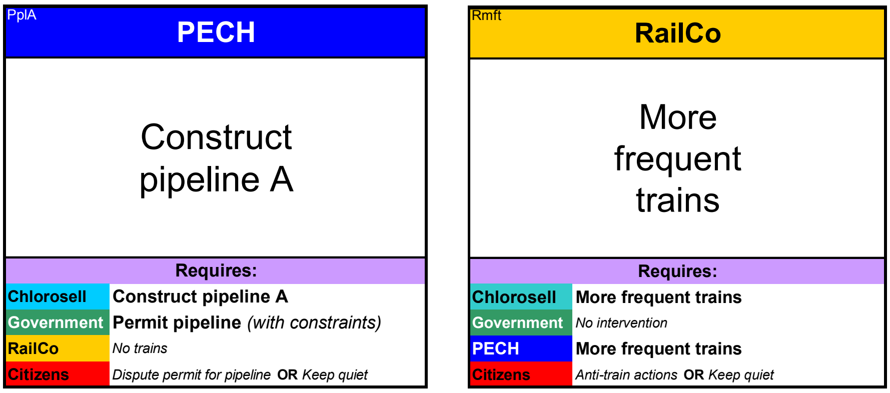

Fig. 2. Examples of a game cards

The industrial chlorine metagame is structured in three phases: preparation, negotiation, and evaluation. In the preparation phase, the objective of the meeting is introduced and the game set-up is explained to the participants. Stakeholders are issued a set of cards that represent their options. The cards (see Figure 2 for two examples) state the name of the option, together with the options of other stakeholders that are *required* in order to be able to realise the option (printed in bold face) and the options that the remaining stakeholders can choose from in case a feasible scenario is reached (printed in italics). To create a sense of urgency in the game, it is impressed upon the stakeholders that time is an important factor. If no feasible solution is reached after the pre-defined number of rounds, this means that no chlorine is transported at all. None of the commercial actors will make any profit (in fact, they will all have financial losses) and government is harmed by the severe negative consequences for the regional economy.

The stakeholders are then asked to prepare for negotiation with the other stakeholders. Participants are asked to devise a strategy for negotiation, but also to score their relative preferences for all available stakeholder options, and also to state which positions they expected the other stakeholders to take. This stakeholder preference information is needed to calculate their cumulative preferences for the feasible scenarios, which allows calculation of the marginal utility of the stakeholder moves in the strategic map (the numbers in Fig. 1), which is used in the metagame analysis after the game session. The preference scoring also stimulates the participants to reflect on their objectives, the ways in which these objectives are influenced by the different options, and the stakeholders with whom they should discuss to promote their objectives.

The negotiation phase is structured as a sequence of 15-minute rounds, with each round divided in three 5-minute blocks. The first two of these blocks are to be used for discussion in small groups of two or three stakeholders. In the last block of a round, all stakeholders meet in a plenary discussion to come to their decisions for this round. To allow stakeholders to behave strategically, they are not asked to publicly announce what option they actually exercise. Instead, the stakeholders inform the facilitator of their decision by submitting one of the option cards that are issued to them at the beginning of the game. They also record their decision on their personal game form, together with the options that they believe that the other stakeholders have submitted. This explicit record keeping can help a stakeholder to determine his/her strategy for the following round, and it produces information to be used during the evaluation phase. The facilitator reviews the submitted option cards and then merely announces whether agreement had been reached. If so, the game is ended; if not, the cards are returned to the players and a new negotiation round starts. The above procedure is repeated until a feasible combination of options is reached or four rounds have been played.

The evaluation phase starts with a brief presentation and analysis of the negotiation results. The participants then discuss their preferences and negotiation strategies and reflect on their recorded perceptions of the positions of the other stakeholders. Finally, the facilitator presents the strategic map and leads the group to reflect on the rationality of the negotiation process in view of the original stated preferences.

5 Experiences with ‘playable metagames’

Until now, the Industrial Chlorine Transport metagame has been played with the professionals from industry and government agencies who participated in the past three classes of the Master’s of Safety, Health, and the Environment programme, and also with students enrolling in the undergraduate programme in Systems Engineering, Policy Analysis, and Management taught at Delft University of Technology. With its simple attributes (a set of coloured cards, preference forms and game record forms), the game is easy to set up and requires no advanced facilitation skills. Although the role descriptions are fairly straightforward, the stated stakeholder preferences can vary significantly. The game rarely ends in an impasse, and all generic scenarios have been observed to occur. The apparent preference for pipeline scenarios and on-site production scenarios may be attributed to the lack of ‘hard’ data on the required capital investments and the risks associated with each option. In some cases, participants show creativity in their negotiations: a repeatedly observed compromise is that PECH opts for on-site production of chlorine and counters Chlorosell’s threat of immediate discontinuation of its deliveries by letting Chlorosell construct the chlorine plant. Invariably, the interaction between the stakeholders is lively and the evaluation shows that participants gain an appreciation for the dynamics of multi-stakeholder decision making processes and the important role of argumentation and negotiation skills in such processes.

The positive experiences with this first playable metagame suggest that actually playing a metagame in a participatory mode adds value to performing a metagame analysis in ‘desk-oriented’ mode. To investigate this ‘hunch’, we field-tested our participatory variant metagame analysis in the context of the National Water Resources Plan (NWRP) project in Egypt. The details of this application of a ‘playable metagame’ in a real policy setting (Hermans et al. 2002, Hermans and Bots 2003) are beyond the scope of this paper, but the findings in this case are relevant as they counterbalance our initial enthusiasm.

The metagame model of drainage water re-use that was developed in consultation with the NWRP team was quite similar to the Industrial Chlorine Transport metagame: it involves five stakeholders (the Ministry of Water Resources and Irrigation, the Ministry of Agriculture and Land Reclamation, the Egyptian Environmental Affairs Agency, the Ministry of Health and Population, and the National Organisation for Potable Water and Sewage Disposal) and three generic scenarios (maximise drainage water re-use, limit its re-use, or stop its re-use altogether). The model was considered to be an adequate representation of reality, without being too complex.

The game proceeded in the three phases described in the previous section, but with more time allocated to the negotiation phase. By playing the game, the participants learned about each other’s preferences, the interdependencies between stakeholders, and the necessary trade-offs between different stakeholder objectives, and they were also inspired to identify compensation, resulting in new options for compromise. Moreover, the game revealed informal power and unofficial options that were not identified during the first analysis.

Despite these positive results, the NWRP project management decided not to use the metagame approach in a participatory setting with the project’s real stakeholders. A metagame workshop with real stakeholders was considered useful only if it would cover all water management issues. An incomplete metagame model would be too much like a ‘game’, and this might disappoint the senior officials that were part of NWRP’s stakeholder committees. Since the relatively simple case of drainage water re-use had already required considerable effort, the NWRP project management doubted whether the expected results of developing an using a full-scale playable metagame analysis would justify the costs.

6 Playable metagames: Discussion and conclusion

Our experiences show that ‘playable metagames’ are instructive for those who are unfamiliar with strategic behaviour in multi-stakeholder policy contexts, and fun to play. But the primary objective of our research was not to develop a didactical instrument, but to develop a method to support participatory policy making. Even though our application of a ‘playable metagame’ in Egypt was both unique and full of analytical, cultural and political complications, we believe that it is warranted to make some more general observations concerning the use of metagames as a method for participatory stakeholder analysis.

There is no doubt that stakeholder analysis of any kind can make a valuable contribution to policy processes. The identification of relevant stakeholders, their options and interests can give insight in positions, dependencies, and possible strategic behaviour of stakeholders, which will improve policy analysis, design, implementation, and evaluation. The advantage of metagame analysis over other gaming approaches is the possibility to compare the scenarios predicted by the metagame model with what actually happened during (simulated) negotiations. This feature is valuable for the learning process of both participants and analysts, but it also requires the formulation of metagame models that provide an adequate representation of the policy context.

Participatory stakeholder analysis with metagames is problematic. If real stakeholders participate, they will demand the model to be very realistic. Moreover, intervening in real policy making processes means dealing with implicit and ambiguous power structures, stakeholders with hidden agendas, and with various political and cultural sensitivities. During the analysis, stakeholders may show politically correct behaviour, inspired by formal and official practices, but during the real negotiations their behaviour will be different, driven by other hidden motives and considerations. Moreover, a small model that concisely defines stakeholders, options and feasible scenarios may not offer the manoeuvring space real stakeholders will require in their negotiations, whereas large and complex models will be expensive and time-consuming to build.

Even if the cost aspect can be overcome and large, complex playable metagames can be constructed, those stakeholders who expect to gain from strategic behaviour may not want to participate. Metagames in particular make stakeholder positions, their power, and their possible strategic behaviour explicit, while some would prefer such aspects to remain hidden.

Does this mean that the concept of ‘playable metagames’ is merely academic? We think not. The participatory application of metagame analysis merits further development for two reasons. Firstly, because actually *playing* a metagame gives insights that are not obtained through formal analysis of the underlying model, even if the players are not the real stakeholders. Secondly, because it is conceivable that one or several influential stakeholders recognise that participatory stakeholder analysis may help to avoid certain types of strategic behaviour, and propagate its use. In infrastructure planning, in particular, national and regional governments may take this position. As for the effort required, relative to the huge amounts of taxpayers' money that are invested in infrastructure, the cost of developing and playing realistic metagames would seem to be surmountable.

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