The Role Playing Games in an ABM Participatory Modeling Process: Outcomes from Five Different Experiments Carried out in the Last Five Years

Patrick D'Aquino, Olivier Barreteau, Michel Etienne, Stanislas Boissau, Sigrid Aubert, François Bousquet, Christophe Le Page, William's Daré.

CIRAD, BP 175 Saint Louis, Senegal; (daquino@cirad.fr)

Astract: Since 1996, we have used Role Playing Games (RPG) with our Multi-Agent System (MAS) platform, CORMAS (Bousquet *et al.* 1998), in different experiments about local land use management, water management, negotiations between foresters and breeders, and preservation of wild genetic resources by local peasants. Each experiment tested a different sort of coupling between RPG and CORMAS, from a RPG simply explaining the MAS model to a RPG strongly evolving in the different steps of the modeling itself. Each experiment tested also different objectives for this linking, from the improvement of the modeler's knowledge about the issue to the support of an endogenous debate within the local community. For a better knowledge of the use of these games, we varied in each experiment (i) the links between the games and the reality; (ii) the nature of knowledge put at players' disposal (players' knowledge or external expert's knowledge, technical or social knowledge,...); (iii) the adaptability and the upgrade ability of rules; (iv) and of course the supports of the game (board game; links with MAS; type of rules, players and organizer,...). Finally, the difficult question of validation was started on by several ways, from computer and statistical validation as well as the different possibilities of players' validation. In this paper, we have begun a formalized appraisal of these six experiments, allowing us stressing the advantages and disadvantages of each methodological step as regards the different possibly purposes of the participatory modeling.

Key-words: Participatory - Resources Management - Role Playing Games - Agent Based Modeling

1. ROLE PLAYING GAMES AND AGENT BASED MODELING IN NATURAL RESOURCES MANAGEMENT.

Role playing Games (RPG) have already been often used in natural resources management matters. But for operational uses, they are reported to be limited because their cumbersome setting up, their slowness to develop a practical action and the uneasy analyses of their results. Then, computer modeling is interesting, and peculiarly multi-agent methodology [Ferber, 1995], [Bousquet et al., 1999], [Bousquet et al., 2001]. This is why our team previously designed a special MAS platform, CORMAS[1] (COmmon-pool Resources and Multi-Agent Systems), that simplifies task of simulating and provides a heuristic modeling support [Bousquet et al., 1998]. Like RPG, CORMAS allow a gradual and iterative learning-by-doing progress, as modeling could start up with only some formal rules and being continually improved according to earlier simulating behaviors and to decision-making process progressing. Then, as regards the difficulty to keep aware participants within long and repeated periods of playing, this MAS platform provides a great improvement in our numerous experiments letting practitioners to easier reproduce and extent gaming processes.

Actually, all the CORMAS flexibility leads to a real incremental, progressive and iterative support for accompanying the complex land use management: the *Companion Modeling Approach* [Bousquet et al., 1996], [Bousquet et al., 1999], [Barreteau et al., 2001], [Bousquet et al., 2002]. Facing to environment management issues, which are complex and unpredictable, principals have to contend with along an iterative route. Hence, we think that supporting decision-making processes means help them to confront the different points of

[1] See http://cormas.cirad.fr. CORMAS is a free plat-form available to the scientific community.

view in an understanding and analyzing iterative process. *That means leading a design processing of supports, tools and consequently upstream models, along a continuous and iterative confrontation between theories and terrains*. This designing approach sets within continual comings and goings between model and terrain, more fitted both an incremental advance within management issues and the necessity of confronting contradictory points of view. Here, we focus on those of our experiments that used RPG: on one side RPG for their abilities to initiate a collective understanding of analysis then modeling, on the other side MAS to better tackle the different processes involved in a natural resources management. The researcher conceives a first representation of the matter, including from participatory inquiries, then sets up his comprehension of the matter within a model, say RPG or MAS models (see Figure 1).

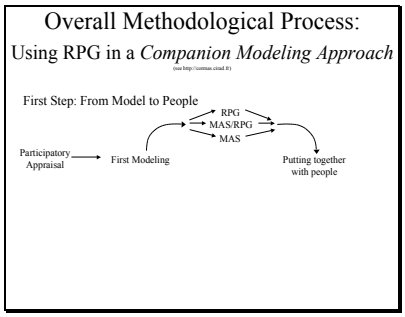

Figure 1

Afterwards, he amends his first knowledge (and model) from results and debates, within a RPG or MAS models (most often the same as the previous but in some cases a new one). Thus, this is not a simply share with people but a very "putting together" process, which allow the both part to involve in the social construction of the matter perception. This "putting together" process is leading to correct the first designer's knowledge (and model).

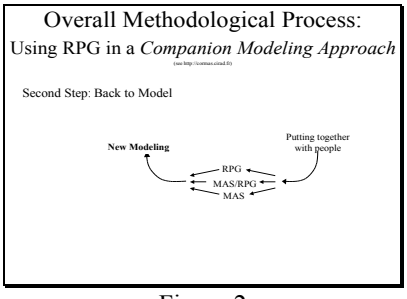

Figure 2

This is the first looping of a continuous and iterative spiral between designer and people (see Figure 3), which then evolves within different ways according to the purposes of each experiment. For instance, the comings and going may lay between people and RPG, or people and MAS, or people and the both. Likewise, they may implied the design of different generation of models (RPG or MAS) along the process (see below).

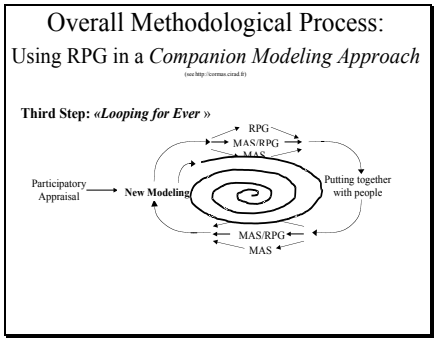

Figure 3

Finally, after the first achievements of this RPG-MAS coupling, this iterative process is being connected with more usual technical simulations (technical forecasts, indicators providing, bio-physical dynamics reproducing,...) and Information Systems (Geographic Information Systems, Data Bases,...). While these last technical supports are useful to help operational management, RPG-MAS coupling seems to us well suitable to politic and collective decisions and actions.

We have then used the joint use of RPG, MAS models and other modeling tools (say GIS) within more than ten experiments in Europe, Africa and South Eastern Asia[2]. The main objective of these researches is to study the use of these tools for knowledge integration in collective learning processes. But hence, between people, game, computer... and reality, the complexity of interactions and the many possible forms of dialogs are widely multiplied. Such a method relying on MAS and RPG to deal with natural resources management issues depends on several elements: joint field study with design of MAS [Bousquet et al.,1999], design of the game content and organization, feedback from game experiments to the MAS and the field. The main difficulty is then not to lose the priority objectives of the approach, i.e. support a management process, by wandering into devices designing, modeling and gaming improvements. The relationships between simulation models and collective decision-making in natural resource management occupy a large part of the literature on adaptive management. But even these participatory approaches could have deeply different objectives and strategies [D'Aquino et al., 2002], which again diversified implicit and explicit incentives, then supports, of

[2] See http://cormas.cirad.fr.

possible approaches. That is the reason why we have begun a precise methodological comparison between several experiments combining RPG and MAS in a participatory way to support natural resources management issues.

2. FROM CONSCIOUSNESS-RAISING TO INTERNAL MEDIATION, A WIDE RANGE OF METHODOLOGICAL PROCESSES.

We will focus here on the comparison of five of our experiences. The first operation, called "SHADOC", was conducted in the Senegal River Valley [Barreteau et al., 2001]. The research question was on coordination methods and the viability of irrigated systems. A model was created and a RPG designed to present the model to the various stakeholders. The model and the game developed were an experimental aid for studies of real systems, with constraints of size, duration, parameter control and most of all, ethical positions which made experiments on real systems out of consideration.

The second experiment is a RPG called “Stratagenes” in Madagascar, which helps transferring plant genetic resource management to local communities. It involves biologically, economically and legally complex processes. The aim of the RPG was to help for negotiations between stakeholders in biodiversity management processes. The players are challenged to negotiate, within a limited time, a transfer of responsibility enabling viable management of plant genetic resources and a fair share-out of the resulting benefits.

The third experiment, called "Sylvopast" [Etienne, 2002], was set out to predict the impact of silvo-pastoral developments of French Mediterranean forests, within the framework of forest fire prevention plans. The model was developed to represent the vegetation dynamics according to management and to describe possible strategies for compromises between breeders and foresters. It was then simplified into a RPG with a view to producing a typology of land management strategies and negotiating static, and to provide training supports.

The fourth experiment seeks to simulate possible reactions to the pine encroachment in a limestone plateau with high biodiversity in south-central France. The "Mejan" model help the different categories of protagonists to exchange their views on the ecological process. A first MAS is based on scientific knowledge, then a simplified MAS is drawn up to make this formal expression accessible to agents and share the representation of the system with them. This simplified model was used in support of a RPG.

The last experiment, called SelfCormas, is to sustain discussions between populations and their local representatives in a decentralized allocation of land in the Senegal River Valley. RPG were used to help stakeholders develop an endogenous shared model, which was then computerized with MAS. The model was afterwards used to simulate the scenarios imagined by the stakeholders, and triggered a group discussion of the possible evolution of the interactions between users and resources, and of the steps that could be taken.

These experiments are at once so different and so close that it may seem difficult to set up an efficient overview. This is the reason why we were thinking of a scrutinizing appraisal framed in a same perspective. This is our *analyzing framework to compare RPG in use*, already applied in our five experiments. This appraisal is focused on seven main topics: At first, aims and strategies of the researcher; Then, the main purposes of the game, with a stress on the links the researcher assumes between game and reality; Next, the precise configuration of the game, its supports and analysis; At fourth, purposes of the MAS; Next, the links between MAS and RPG the researcher opts for; Then, the validation process he reckons; Eventually, the perspectives of uses. Hence, all our experiments can be viewed through this methodological process. The first fact coming out of this overview is about different methodological options of each experiment, according to its peculiar purposes and environment.

The SHADOC experiment begun in a first modeling, then a share with people, then a very new modeling (MAS_2) which is afterwards leading towards two different interactive processes: the first between designer and his iterative model and a second between designer and people, for a practical use in irrigated scheme management (Figure 4).

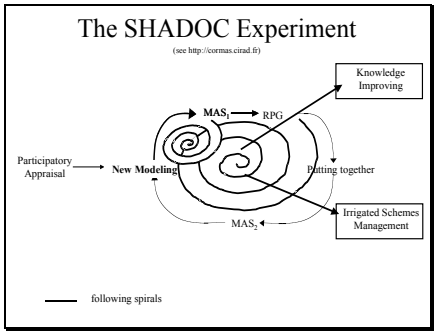

Figure 4

We have the same sort of iterative spirals in others experiments (see Figures 5 to 8).

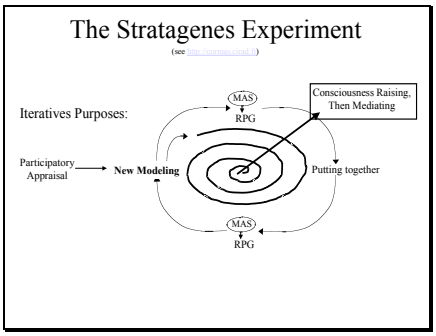

Figure 5

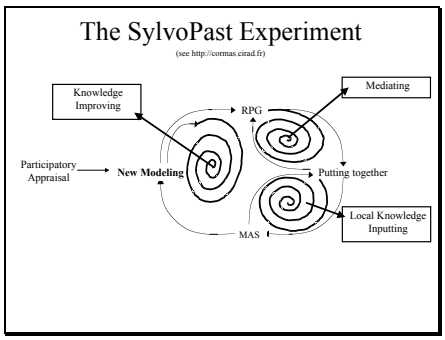

Figure 6

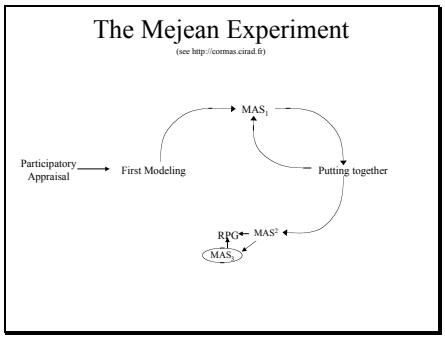

Figure 7

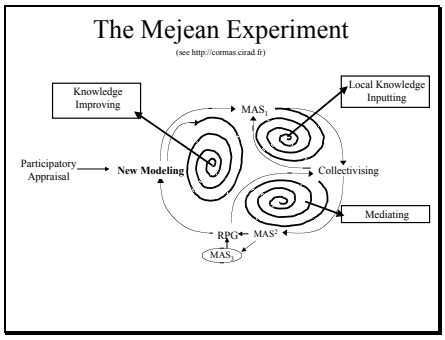

Figure 8

For its part SelfCormas focused on a initial stage before the modeling cycles (Figure 9), where participants carried out a learning-by-doing process that allows them to better handle Information Systems, modeling and leading of a collective decision process.

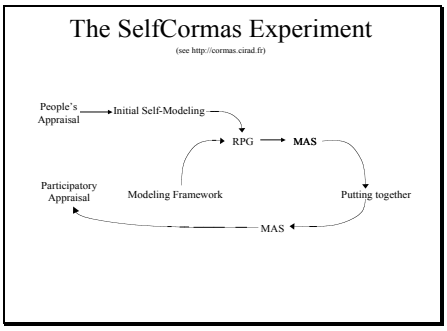

Figure 9

Here, the process begins directly by the participants' set down of their own thinking model by the way of common workshops. Next, participants translated their own thinking model in a crude RPG. Then, the results were translated into a MAS model after some games sessions. And it goes on within usual companion modeling looping (Figure 10).

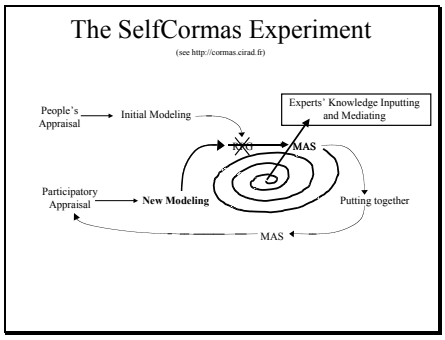

Figure 10

Within these experiments and again the others of our team, there is the widespread range of purposes. In all the cases, the process is used to improve the dialog between people within a decision process on natural resources (or land) use management. But this may target quite different people it could be useful to distinguish better : "users" (who need resources to product), "stakeholders" (who have a special interest over some resources), "representatives" (who have a legitimate authorization to defend some users or stakeholders); "principals"(who have some legitimate responsibilities to decide over the management of land or resources; "experts" (who some special knowledge on a issue). Likewise, reasons of this knowledge improvement spread from whether a mere scientific survey, or supplying solutions to a decision process, or providing mediating supports. Even into this last sense, we can have quite different objectives, from helping negotiations to get a blocked dialogue moving again (bringing together divergent points

of view), to facilitating debates (providing a mere communicating framework without needs of coming together some points of view). In truth, one can point out some real different options to help a decision process: a sole internal (self) legitimization as regards a decision process, a local points of view exchanging, an external recognition of local points of view and knowledge, lastly an exogenous information and knowledge input.

In the use of RPG, two different main purposes can be found out. Both are present but not in the same weight in every experiment. The first one is to translate and discuss technical results towards people. It can be justified whether to validate knowledge for "external" agents (technician, expert, researcher, etc.) or to provide knowledge into some local debates (negotiation, decision process, etc.). The second one is to collect participants' knowledge or points of view. It can be justified to integrate local knowledge into external agents' analysis or on the other side to help participants to better understand each other. We then can call the first purpose "external knowledge conversion" and the second "internal knowledge assembling". This first overall examination leads us towards two sorts of links between purposes and methodological options. The first one is about the quite different natures of "knowledge" we resort to, and the second one has to do with the different perceptions of the "reality" we touch on.

We can also associate another implied element with every peculiar purpose of our processes: the links thought by the researcher between the game and the reality. We then distinguish here a two - faceted reality: (i) the *explicit* reality, i.e. all things perceptible about a given situation (*displayed* rules, *acknowledged* incentives of behaviors,...in fact all we can *see or hear*); (ii) the *implicit* reality, i.e. all intangible, sometimes subconscious, elements (incentives, rules, socio-politic or cultural power struggle,...), in which behavioral patterns have strong roots. In this layout, links with reality are into what happens around and outside the rules game: in other words, the "inner game". Hence, what sort of reality we attend to represent? If it is the explicit reality, the rules and the setting of the game are featuring some pieces of reality observed and displayed regulation. But if it is the implicit reality, it may be more interesting to let more freedom to the players, peculiarly concerning the part of the issue we would like learn from the game. *This implies players could know more about the situation played by their own understanding and knowledge of the reality than sometimes by the gaming supports*. For this reason, the profile of these players is crucial and it is essential to set up a group players with the suitable "community profile" as regards the given matter. Likewise, one may let these players as free as possible into the game, to let a near reality situation rises up. In the same way, in this layout, it might be essential to let each player plays is own real character, because his well self-knowing of it. But on the contrary, in some cases only different players will play the real behaviors of a situation, because the real character's not-daring or wants to hide some elements.

3. OUTCOMES AND PERSPECTIVES.

In this paper, we have organized a formalized appraisal of five of our experiments. This first overview drawn from our analyzing framework is certainly a beginning but so far not enough. Peculiarly, it is now interesting to clearly position the different purposes according to this first methodological perspective we have picked out: say the points of view about knowledge and reality. What is the expected use(s) of the process? We are indeed within a large range of possibly purposes. Consciousness-raising workshops above all worry about gaming supports accurately informing rather than the sociologic sensitivity of the game configuration; next, improving local people's knowledge leans on passing on the explicit knowledge but also on letting people adjust the explicit rules and knowledge, whereas improving the experts' knowledge looks for local knowledge on the contrary; then, communicating purposes lean on passing on the explicit knowledge as well as letting people adjust the explicit rules and knowledge; eventually, mediation and negotiation help different people exchanging their understanding in a situation with rather implicit difficulties. We are now envisaging a methodic comparison coupling different devices and processes experiments within scientific debates. This new campaign of experimental comparisons couples multiple tests and scrutinizing analyses especially leaned on sociological, political and cultural effects as well technical configuration assessments. On that last topic, we work not only on methodological processes but also on CORMAS and gaming supports enrichments to still increase theirs flexibility and opening aspects.

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