Model designed through participatory processes: whose model is it?

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Modèles conçus dans des processus participatifs : à qui appartiennent-ils ?

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Abstract

Participatory modelling is increasing steadily in importance because of opportunities to obtain new; kinds of information, perspectives on validation and implementation of social learning. The concept of participation is spreading towards modelling processes. It uses a wide range of approaches, however, differing notably in relation to timing and involvement of stakeholders in the design process. The inclusion of stakeholders in the design process might alter the usual notion of authorship as well as ownership or appropriation of these models. In this paper we address the issue of ownership of participatory-designed models through examples that have been investigated in the FIRMA project, and through discussion on timing and level of involvement of stakeholders in the design process. The issue of ownership of models itself has to be explained because it is made up of several property regimes. As far as models are concerned these various facets of ownership are: authorship, allowance of use, permission to modify, responsibility for content, responsibility for use, control of access, control of use, and defining the proper use of models. If these facets of ownership are not properly defined, this may generate several types of conflict or under-use of the model. Technological control and legal control are the current ways of dealing with this issue of ownership through passwords, licenses, software agreements, specific interfaces, etc. Their translation to participatory-designed models may not be easy since there is a required dispersal of the model among participants, and any form of appropriation of the result by only one party of the participatory process might be difficult to justify. Participatory modelling (PM) is, however, also paving the way for a third way of dealing with this issue of model ownership through the development of mutual appropriation of the model: i.e. through a thorough and pragmatic knowledge of the model. This third way is analysed through three case studies of PM, all within the frame of the FIRMA project. PM in itself is not sufficient to make

this third way enforceable. The issue of timing and level of involvement of stakeholders in design and use has to be considered. Ownership of models is the result of this pattern of interactions among stakeholders (including scientists) mediated by the model itself.

Résumé

La modélisation participative est de plus en plus fréquente, étendant le concept de participation à l'activité de modélisation. Elle utilise une large gamme d'approches, se différentiant par le niveau et le temps d'implication des acteurs. L'inclusion des acteurs dans la conception altère les notions usuelles de propriété et d'appropriation. Dans cette communication nous nous intéressons à la question de l'appropriation de modèles conçus de manière participative dans le même contexte du projet de recherche FIRMA, via une discussion du niveau et du phasage de l'implication des acteurs. L'appropriation des modèles est discutée selon plusieurs dimensions : droits d'auteur, droits d'usage, droits de modification, responsabilité vis-à-vis du contenu, contrôle d'accès et définition des conditions d'usage. SI ces différentes dimensions ne sont pas correctement appréhendées cela peut amener à des situations de conflit ou de sous emploi des modèles produits dans des démarches participatives. Le contrôle technologique ou légal sont les moyens courant actuels pour traiter cette question sur les modèles produits de manière classique. Leur traduction pour des modèles produits de manière participative est difficile du fait de la distribution des droits et responsabilités perçus. La modélisation participative propose une troisième voie vie une appropriation mutuelle des modèles ainsi produits, impliquant une connaissance profonde et pragmatique de ces modèles. Nous analysons cette troisième voie au travers d'une comparaison des études de cas du projet Firma. L'appropriation des modèles et le résultat de processus d'interactions entre les différents acteurs (inclus les modélisateurs), via l'intermédiaire du modèle lui-même.

Keywords: participation, appropriation, model use

Mots-clés : *participation, appropriation, usage de modèles*

Introduction

As far as simulation models are concerned, most modellers feel their models are not used enough at the operational level they aim at. In the meantime, they are afraid they could be misused and therefore try to keep control of their use as much as possible. In the modelling community there is a strong tendency in seeking new approaches improving suitability, adaptability and finally "correct use" of models. These approaches are related to the software engineering community with, for example, object-oriented methodologies, or extreme programming as well as to social sciences focusing on the use of technological artefacts such as soft system methodology [Checkland and Scholes, 1990].

The implementation of public participation, however, at least at the local level, needs tools such as models. The involvement of stakeholders is increasingly required in public policy design. The last EU Water Framework Directive, in the following of Aarhus convention, is dedicating one article to the obligation of informing and consulting the public at the various stages of its implementation. This general trend of more involvement of stakeholders and citizens in public policies is not only a new position at the top of policy making hierarchies, nor is it only an objective for some NGOs and activists groups. It has also been internalized by practitioners who feel they are in need for tools and methods to put it in practice [Richard, 2000]. Practitioners need tools they can handle and get experience on them.

Modellers seeking to produce suitable models to be correctly used on one side, practitioners who are involved in public policy implementation look for tools and methods supporting them in involving stakeholders on the other side: this reveals a gap with the issue of the *appropriation* of these tools at stake. Moreover, this leads to an unspoken question: who owns the model? We aim at addressing this question in this paper as a mean to progress in bridging this gap. However, due to our background, we focus on models as a specific category of tools, and we even

more focus on participatory built models. For this category indeed, authorship of models as a driver for appropriation is blurred as well as deep knowledge of content might become uncertain as it becomes more distributed.
This paper looks into the various dimensions of ownership and appropriation. And, upon the basis of three case studies, for which at least one of the authors was involved in conducting participatory modelling process, it provides suggestions about the consequences for use of different dimensions, and how to set pathways to handle these various dimensions in various contexts.

This paper is first presenting the new stakes emerging in the path of participatory modelling, taking in account the diversity of participation implementing ways. Then the 3 case studies on which the comparison undertaken are built upon are presented. Finally the various dimensions of appropriations of models as output of these participatory processes are discussed with a special focus on practical appropriation since the dilution of feeling of ownership might lead to non use of models.

Participatory Model Development

New Trends in Modelling

Participation or involvement of stakeholders is increasing quickly, and has reached the field of doing modelling as well. The arguments for the increase of participatory processes refer to situations when collective decisions have to be taken among actors in complex networks with diverging stakes [Driessen et al., 2001] or for "wicked problems" characterized by complexity and uncertainty [Funtowicz et al., 1999]. It is expected through participation it is possible to reach efficiency and acceptability of decisions [Driessen et al., 2001] as well as to lead to a sharing of competencies [Selin and Chavez, 1995].

The diffusion of this principle of involving "concerned people" [Claeys-Mekdade, 2001] to model design stems from two approaches. On the one hand the use of simulations and scenarios as means to support participatory processes has raised the issue of their own participatory character. On the other hand the complexity of issues tackled through modelling, notably in the field of natural resources dynamics, is leading to acknowledge the necessity of some collaborative design, such as involving stakeholders in the process of designing a model, whatever it might be meant for. For example Participatory Modelling (PM) is supposed to increase the sharing of assumptions lying behind the models developed but also behind each stakeholder's mental model [Ramanath and Gilbert 2004].
PM is also argued to make users of model results more aware of the value of these results: preventing from total distrust as well as from uses out of relevant domains. It is a way to partly open the black box of models so that these users can better assess the results of these models and their uncertainty.

Methods to implement PM are, however, far from being established, and are more on the research level. However, there are already a few experiments that have been conducted [D'aquino et al., 2002; Hare et al., 2002], and other experiments that are on going. These experiments have hardly ever any clue or any clear statement about the ownership and responsibility on the collaboratively designed product of various participants in the modelling process.

Diversity of Implementing Participation

At least two types of variability are appearing in participation. First and most commonly regarded is the scale concerning participation levels of Arnstein [Arnstein, 1969] or its adaptation by Mostert [Mostert, 2003]. What is named participation might refer to co-decision as well as to mere information or consultation of concerned people. The call for more participation might head towards various objectives, and is sometimes more an issue of labelling than of changing collective decision making practices?

This scale suits PM as well with only a few translations as shown in figure 1, which proposes various levels of implementation of participatory modelling, from low involvement (showing simulations) to high involvement with stakeholders designing the model themselves.

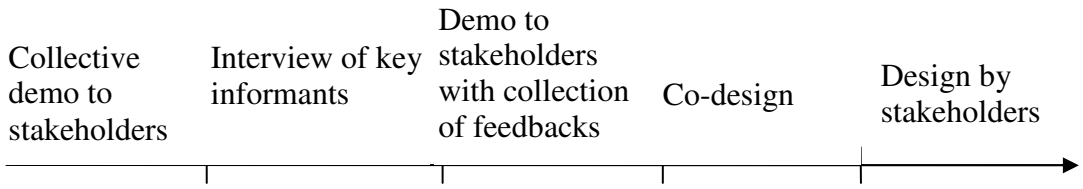

Figure 1: Adaptation of Arnstein's participation level scale to Participatoty Modelling

A second key of diversity in implementation of participation is the range of stakeholders involved in the process. From a broad public to a focus on a few selected stakeholders, the participation or involvement of concerned people can not be considered as the same collective decision protocol.
On a PM point of view, this is translated in the size and specialisation of the actors sample involved in PM. For methods such as Use Case Diagrams, this means that information from relevant users is not always provided directly by them which is decreasing their relevance [Bustard et al., 2000].

A third key of diversity in implementation of participation appears to be quite discriminating: the stage in the collective decision process in which participation is involved [Johnson et al., 2003; de Boer, 2003], from the early framing stage towards the final implementation choices. A late involvement might provide the illusion of a high level of participation, since stakeholders are asked to choose among a few possibilities, with their choice determining the final decision. The scope of their choice is, however, limiting their real power in the decision process strongly [Marengo and Pasquali, 2003].
For PM, this diversity covers involvement in various stages in the model design process: identification of key variables, choice of main assumptions, conceptual model design, and prototyping. In this case, it is even complicated by the frequent occurrence of cycling modelling process such as Kolb's cycle [Kolb et al., 1991], Evolutionary System Design [Shakun, 1996] or Companion Modelling [Bousquet et al., 1999]. Participation might take place all along a cycle, or at a specific stage of the cycle or in specific cycles, more or less at the beginning of the modelling process.

The relationship of stakeholders to the output of a PM process will depend on their specific involvement among all these possibilities. Feeling of ownership or handling (of what) has to be considered according to this involvement.
This leads notably to mobilize some arguments developed around the use of ICT tools especially in sociology and sciences of communication. For instance, the studies of use are bringing the place of user to light in the innovation and conception processes and analyse the significance of the conception process in the design of 'ideal' user and so uses.

The Role of Users in Conception and Innovation Processes.

The 'sociology of uses' — in French 'sociologie des usages' — has been developed in the Information and Communication Tools' field by French-speaking researchers [Le Goaziou, 1992; Jouet, 2000; Proulx, 2001]. This sociological position gives us some viewpoints to move on to the issue of the impacts of ICT on societal organization and can be useful to understand the practical appropriation of PM.

The first point is to not divide the building stage from the use stage. It means that for the people who build (technical) objects as well as the sociologist who observes the social processes, the building work or observation must be done as a continuum between all the stages of the object's life. So the use's stage might be analysed only if one takes in account the design's work and the organization that it carries, as well on the designers' as on the users' side. Thus, the use's stage is like the moment and the place of a meeting driven by the attempt to carry out a convergence between (n) stories, (n) processes and (n) dynamics.

'Sociology of use' points out the fact that part of designers think that there is one right way to use their 'creation' and that the other ways are 'inaccurate' or 'bad uses'. For other ones, the fact that potential users don't use properly the object means that they are behind the times. The sociology of use or the sociology of object underline clearly that nobody really knows how a (technical) object will be received and used in the society or in a group. So, intrinsically, it could not be 'bad' or 'good' use. The technical innovation gets really meaning only through what the users do with it and the users' practices form part of the innovation chain.

None human is absolutely virgin in front of the technical object: even the Indian of remote Amazonian jungle will have a baggage of representation, culture, stakes in front of it. Thus, every one will have:

- His/her knowledge or his/her un-knowledge about the object,
- The reasons why he/she decides to get it or to not get it,
- How the object will come in useful for him/her,
- The constraints that its use will cause.

So it is necessary to move away from the image of an isolated user in front of a machine. First, the social environment will have impact on use and, of course, more actors are involved around the human/machine relation — i.e. the retailer, the fitter, the friend, etc — but also things — instruction, element of the system —; all of them will be the mediators of the interaction, having for function to read, to decipher, to translate the machine's program for the user. There will be essential in the relationships' building.

Another point is linked with the previous one, is the fact that modelers, engineers propose to potential users or consumers technical objects already 'formatted' with a number of prescription and instructions that could be understood as a grammar of 'good use' and generate some effects:

- To embody a virtual user with ideal characteristics,
- To format the potential user through the design of the object,
- To engrave the 'ideal' use in the object
- To create a use's discipline with regulations, prohibition, constraints norms.

This point means also that, some time, the designer expect more than the user is able or prepared to do with the object.
All of those points will bring the question of the appropriation through PM's processes on light and how this issue is lay down by the modelers themselves. Therefore, one of the main issues raised by the modelers is the question of 'good' or 'bad' use.
So, it means that the participatory processes, where stakeholders are involved, do not solve all the questions of 'appropriation'.

- The modelers cannot anticipate all the potential uses but in the same time try to prevent the problem. It means that the model might be 'formatted' by the prescriptions, the technical system and the transmission process in that way.
- At least, they already create a kind of 'virtual use' or 'user' that will help them to evaluate the uses done later.
- The stakeholders' involvement will add some more strategies, points of view, and register of value around the model. As much as new kind of prescription that will have for function to read, to decipher, to translate the model's program for the users but that will not prevent everything also.

If we follow the assumption, we can postulate that the model will include part of stakeholders' representations, strategies, culture and so on. We can also postulate that part of the appropriation process by the stakeholders will be partly done as well as for the modellers.

Examples of Participatory Modelling

Firma[1] project has been the framework for several modelling processes in 5 cases studies dealing with the implementation of participatory agent based modelling for water management issues. We describe here 3 of them with a special focus on the participation feature of their design and the viewpoints on various stakeholders on the model developed. Each author of this paper has been key actor in the implementation or the observation of one of these three case studies.

It is expected that common initial conditions provided by the development of the tools within the same research project facilitates to sort out reasons for various appropriations and helps for possibilities of comparison

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Phylou: an Agent Based Model of Pesticides Management

PM has been experimented for one year and a half, in dealing with the issue of non-point pollution due to pesticides in vineyard, in a river basin, with a small group of stakeholders involved in participatory water management in their professional activities [Boutet et al., 2003]. Choice of a PM process was intended to raise people agreement on the suitability of the tool to be used as a basis to support dialogue. This working group had formal meetings every three months approximately. These meetings were taking place at the researchers' institute's place. Each of these meetings had the following structure: reminding discussions and requests of previous meeting, explaining how they had been taken in account, showing and demonstrating new version of model, discussing with proposals and requests for a further version. Successive versions or prototypes were confronted to field realities in between.

This process, analysed all along its progress by a sociologist, has lead to the evolution of the working group in a coherent group feeling to share a tool, different to what any of the members were aiming at initially. However when interviewed individually, they had different uses in mind: education for the stakeholders and basis to share representations for researchers.

Zürich Water Game

In the Swiss Case study of the FIRMA project, 8-10 stakeholders were brought together to carry out a co-design participatory management task to discuss and design possible management solutions to the problem in the local City of over-capacity in the water supply. The goals of the project were to increase communication amongst the water management stakeholders in the city and to come up with new management plans that could satisfy the different goals and norms of the stakeholders. Unlike the Maaswerken project below, the development of models was not the goal of project. Participatory modelling was carried out to develop models to support the groups' ability to represent and exchange their own knowledge between each other and to support their subsequent discussions. Two models were developed that are of importance to this paper: a role playing game and an influence model. The influence model represented the groups' shared knowledge of how the water supply and demand system and its subcomponents (economy, consumer behavioural patterns, etc.) worked and interrelated. It was developed by combining the previously elicited mental models of each of the stakeholders. The model content was therefore directly coming from the stakeholders, with the caveat that the project team had to do some post processing of the knowledge in the mental models in order to build a common model in which the same terms were used. The influence model was used to do policy analysis of possible new management strategies. Stakeholders were explicitly asked (and given the means to do so) to change the model during its use if they felt it was necessary.

The role playing game was more loosely based upon the knowledge of the stakeholders. Knowledge from the stakeholders as well as from other sources was

[1] A 5th FP EC research project, Firma, "Freshwater Integrated Resource Management with Agents" - EVK1-1999-70

used. The game also represented a larger simplification of the system than in the influence model in order for it to be playable as a role playing game. The purpose of the game was to allow stakeholders to swap management roles and thus to learn about the management problems each other faced. It was also intended that the stakeholders learn about how their decisions impact on each others' decision making abilities. The stakeholders could request that aspects of the role playing game be changed by the project team between game sessions.

Maasswerken

The participatory process was established and conducted by the project organisation "Maaswerken". All hydrological and morphological processes of the case study are calculated by experts form Rijkswaterstaat (governmental organisation responsible for water management in The Netherlands) and the Maaswerken organisation. Moreover, the organisation was responsible to communicate results and consequences of measures on the environment to the stakeholders, often with mixed results. That means that implementation of a model and interaction with stakeholders from the Firma modeller's point of view was restricted to accompanying and observing functions. Maaswerken and ICIS (FIRMA partner) signed a contract that captures a mutual agreement about the exchange, and use of models and data. This way both parties ensured that no data nore software can be published without mutual consultation. However, other stakeholders were basically excluded from this agreement. Even a very transparent approach on behalf of the Firma modellers could not improve this situation. Up to now models are applied to depict scenarios of possible outcomes after implementing a particular set of river engineering measure. The ICIS team conducted interviews with mixed success. Some of the Stakeholders denied even to respond to a well prepared and in advance sent questionnaire. Later on validation was done by just a few stakeholders, who responded to the use of the model. Additionally, the ICIS model is related to a short section of the river concerning only two villages out of a large number of settlements alongside the river. To this end the IRM (integrated river model) is a model that remains in the hands of modellers and decision makers. The use of the model in public discussion is at least questionable. However, the IRM shows ways that enable modellers to combine stakeholder perspectives on changing environmental conditions such as climate change with various implementations of measures. Possible effects of climate change have not been taken into account by the Maaswerken organisation. A subsequent project IVM (integrated investigation of the Maas) can take advantage of the integrated river model, at least upon the example of the situation at the two chosen villages.
Summarising it can be stated that the meaning of a model must be seen in conjunction with the role of the modeller within the participatory process. A mere observing position has often limited impact to the design of the participatory process. Thus, in this case study a co-design of the model just takes place during short periods of the process. In addition, the use of the model is limited.

Issue of Ownership of these Models

While the ownership of a model is quite clear in traditional way of doing modelling, with clearly identified authors doing the model on their own behalf or on someone else who is paying them for that — for instance, one stakeholder or a cluster is providing specifications and requirements—, it becomes blurred when several stakeholders are involved at various levels in intensity and in timing. What does that change for model's formal ownership as well as pragmatic appropriation or handling, when stakeholders are providing data through interviews to the modeller… or when stakeholders are repeatedly proposing selection of processes to be represented in the model or are evaluating various versions of prototype?

The Various Dimensions of Appropriation of Modelling

We extend here the concept of appropriation, and its various categories as developed for land use issues [Schlager, 1992] to outcomes of PM processes. These categories are rather dealing with control and rights on the model. However in case of more technical objects such as computer models, when specific

knowledge is required to enforce these rights and control, we propose here to add a further category, namely handling, which qualifies the ability to use or control the use of these models.
This adding and adaptation lead to the following categories:

- Right of use: who is entitled in using the model by his own;
- Right to modify: who is entitled in changing either the content or the interface;
- Responsibility: who has a, possibly legal, responsibility in consequences of uses of the model;
- Feeling of "paternity": who is recognizing its inputs in the resulting model;
- Control of access/use: who may authorize or deny someone else the right of use or modify;
- Definition of the standard of use: who is entitled in defining the proper range of relevant uses;
- Handling.

Each category of appropriation might be devolved to a single stakeholder, several or none. These rights might be assorted of conditions such as their simultaneous use of all those entitled.
We will not deal with all these categories in this paper. We will rather take a pragmatic viewpoint and consider the issue of (proper) use of the model resulting from a PM process. Even if the legal aspects are very important, we leave them aside and focus on the practical appropriation of the model.

Practical Appropriation

This viewpoint on practical appropriation of model through the issue of use of model is connected to the power of control on these models: who is entitled and/or able to allow/guide/forbid the possible uses of a given model. While legal or technological control are usual solutions, as far as PM is concerned, this might mean the exclusion of some stakeholders on some rights on the model, which they can genuinely argue for a part of paternity.
In case of frequent interactions, technological barriers are difficult to set up because you have to explain them; legal ones are difficult to legitimize since you needed the participation of the people. We now analyse how the three case studies described above deal with this practical appropriation.

From External Position to Sharing of the Model.

A first case is when modellers keep the model for themselves[2]. Participants have been considered as information providers or "validators". Implicitly it is considered that only the scientists know what the right use of the model should be… or endorse the responsibility of their uses. This last concern legitimates such appropriation: scientists are aware of potential misuses and do not want them to happen. They build upon the technological barrier and do not spread the code of their model. Danger of misuse might be real in some cases, models being used to promote specific decisions while they are not able to.
However acting this way, scientists are thus limiting the creativity of the participants in the modelling in their further use of the model. There is a framing effect of a model considered thus as exogenous and static: if you want to use it you have to fit with its assumptions and interfaces. This might be not very different of classical ways of modelling with key informants.

A potential pitfall: none is appropriating the model. Modellers consider themselves as having a rather technically and facilitator role: as "midwives" they support stakeholders in developing *their* model. Stakeholders consider that they helped modellers in designing *their* model better. The issue of legal ownership might be dealt with through some initial and formal agreement between modellers and stakeholders, based on various inputs provided by each. However this can not tackle the issue of handling. The Phylou case study showed that important and

[2] We do not consider here cases of "robbery" (i.e. modellers used the information provided by participants but considered themselves as the only producers of the model). They are hopefully rare.

repeated involvement of stakeholders in the model design has not lead them to feel like using the model by themselves [Boutet et al., 2003]. If this level of appropriation is to be reached for the stakeholders some specific training and follow up has to be ensured by the modellers. However this may also be due to stakeholders not interested in the model or overwhelmed.
This can even lead to some kind of double lock, when neither stakeholders nor modellers handle the model: only a few are appropriating the model. This can happen, if some stakeholders have particular means and knowledge to access models. This can lead to abuse and promoting self-interested goals.
All these cases are leading to under use of the models thus built.

Empirical studies show that only information common to all members of a group prior to group discussion is used in a collective decision making process: individual information is used but only by the participant owning it [Chernyshenko et al., 2003]. In the case of PM this might provide a key to interpret multiple appropriation of a consensual model, such as in the case of Phylou. Participants could achieve a rather simple model, common to each participant, with all of them having a feeling of paternity. However they had each in mind their own interactions with the field which was not really put in the common ground and thus developed their own potential use. Since none was endorsing the right to exclude someone from using the model… neither to use it alone, it ended up with a non use of the model.

In the Swiss Case Study, the project team never explicitly handed over ownership of the models to the stakeholders; it was simply assumed that they would feel ownership since they had been involved in the development of the models. That is, the project team gave them ownership without asking them whether they wanted it or felt that they had it. The project team assumed that stakeholder sense of ownership would be greater for the influence model, since the stakeholders' knowledge had been more directly implemented in this model than in the RPG.
The stakeholders' subsequent feelings of having the right to modify the models and the desire to have the right to use them after the process was based instead upon the accessibility of the models and how they were used. The influence model was built out of cards stuck to a wipe-clean plastic sheet – this made it easy and practicable for the stakeholders to alter the model as they used it without the intervention or help of the project team. The role playing game had more of a formal structure which was hidden to the players, i.e. the game design that allowed it to be playable as a role playing game was not accessible to the players, and therefore their ability to modify this aspect of the game was almost non-existent. Despite this fact and the fact that the influence model made more direct use of the stakeholders' knowledge, the RPG was the model that the stakeholders wanted to use after the process. However, they still required the project team to make modifications to allow them to play the game outside this process. For both models, it was the project team, which was assumed to be in control of how it was used. Part of the reason for the lack of autonomy on the side of the stakeholders in this respect was because of the nature of the process, in that the stakeholders felt like they had little control over the process since the project team was involved in developing and testing participatory methods. The experimental nature of the process meant that it could not always be made clear to the participants in advance what was going to happen next. The participants therefore often abdicated responsibility for the process to the project team, despite early involvement in the process.
There was no legal sense of ownership defined, since the models were not specifically designed to be used outside the process, though there was a demand for the RPG. The intellectual property rights probably belong to the EU since the project was an EU research project. This makes a difference. If the process had been set up by the stakeholders, then they would have legal ownership.

Table below is a first attempt at summarizing various categories of appropriation of models, reasons for a specific path of appropriation and potential consequences.

Category				Reasons for	Consequences
Right to use and modify		comfort with model			
M	S	M	S		
yes	no	yes	no	control against misuses	framing effect

no	no	yes	no	consider as support providers	under-use of the model
yes	yes	yes1	yes2	appropriation with different purposes	non use of the model
yes	yes	yes	yes	sharing of the model	to be tested

Table 1: various patterns of appropriation (M stands for Modellers, S for stakeholders)

Relation to Timing, Level of Involvement and Use of these Models

Kind of participatory process implemented is explaining partly this diversity of practical appropriation. For example, in the Phylou case study, the frequency of interactions among a few stakeholders and scientists raises the small group constitution effect [Boutet et al., 2003].
Participation early in the process, with the formal setting of beginning the PM from scratch, raises the possibility to stakeholders to feel they are among those who constituted he model, even though they are not the "coding" people. With a mere early involvement, as strong as it might be, stakeholders might however become excluded of the use of the final output without the support of other participants to the PM process (stakeholders or scientists).

Repetitions of interaction allow making the common information really evolve. This repeated mixing of heterogeneous source of knowledge all along a PM process is not enough to ensure a good level and suitable use of the output if the PM process. Experiments presented above have even lead to the opposite effect: repetitions of interaction have made nobody really satisfied for using the model.

Issue of who is entitled in such cases to forbid bad uses of the model, at whatever level it is coming through: necessity of a common agreement between all participants to the uses of the model. This has actually not been done at least in the cases presented above, since the focus was in each case the production of a model. The use of prototypes as intermediary object in the joint model building process with a screen showing slides explaining the structure and dynamics as well as demos has pushed the Phylou process in that way for example. Even though various uses have been mentioned, they have not been fully discussed nor lead to any agreement, even implicit.

Conclusion

This analysis of appropriation here has been made ex post by the modellers themselves, with a specific focus on the issue of appropriation in practice rather than legal or technical devices to strengthen any attempt to appropriate a model. A few pitfalls have been identified such as a lack of real practical appropriation from all the parties paving the way for under-use of the model produced. This is the counterpart of a too strong appropriation by some of the participants, and often, due to technical reasons, these are the scientists, excluding others from an easy access to the model, as a precaution against bad uses.
In all the cases this issue of appropriation in relation with the specificity of a participatory process is not dealt with explicitly. This might be the reason for pitfalls observed.

We have made here an attempt to categorize various evolutions observed in PM processes we were ourselves leading. Therefore this comparative analysis is more raising issues from inside of the process. For further analysis, this issue of appropriation should be part of an on-going evaluation process.
Finally, the use of final output might not be the objective; since social learning as side effect might be the main output, with the model as an intermediary object [Vinck, 1999].

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