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Using Social Simulation to Explore the Dynamics at Stake in Participatory Research

Abstract

This position paper contributes to the debate on perspectives for simulating the social processes of science through the specific angle of participatory research. This new way of producing science is still in its infancy and needs some step back and analysis, to understand what is taking place on the boundaries between academic, policy and lay worlds. We argue that social simulation of this practice of cooperation can help in understanding further this new way of doing science, building on existing experience in simulation of knowledge flows as well as pragmatic approaches in social sciences.

Keywords:
    Participatory Research, Institutional Analysis and Design, Knowledge Flow, Agent Based Simulation

Participatory research: an emerging social practice of science

1.1   Participatory research is increasingly popular at the interface between science and policy. Scholars consider that it might resolve concerns about the use and the relevance of research outcomes by policy makers, the access to relevant information, or the legitimacy of research outcomes and their transfer towards stakeholders (Barreteau et al. 2012). Participatory research has the same objectives of knowledge production as conventional research. " *The key difference between participatory and other research methodologies lies in the location of power in the various stages of the research process*" (Cornwall and Jewkes 1995). In a participatory research, scientists share power on controlling the process at some stage with non-scientists: lay people or policy makers. The effectiveness of sharing power over a research process in practice depends on the implementation of rules meant to cope with the diversity of competencies among participants including scientists (Levrel et al. 2009). Advocates of participatory research suggest it can overcome some limits of conventional research, particularly as far as complex systems and "wicked problems" are concerned (Fischer 1993). Learning of participants is not always an objective as such, but exchanging knowledge and various points of view are continuously used to argue for this kind of approach.

1.2   However, when participatory research is mentioned, there is not so much being said. Diversity of ways of doing it (or pretending so) is nearly as large as the scope of its expected benefits. This diversity is present on the timing of power devolution over the research process to non scientists, on the level of power devolution including the control over the use of the knowledge produced, on the setting for gathering participants (Barreteau et al. 2010). Even with focusing on a specific approach, companion modelling, within a quite cohesive group, one can find a great diversity in the practical details of its implementations (Barreteau et al. 2011).This is weakening perspectives of using such research stance in the future due to confusion or even disappointment with past experience among would-be participants.

Participatory research as an object of investigation

2.1   Scholars are very active in suggesting frameworks to describe participatory research methodologies, but these frameworks do not encompass complex dynamics. Furthermore, they focus on macro-conditions and neglect the micro-level relations among the people who hold the knowledge which is exchanged in these processes, be them scientists or non scientists. Interestingly, Mertens and colleagues (2005) explore the inter-individual level of conversations but re-aggregate data in various groups to point out the specific needs for a participatory research to reach all key actors.

2.2   As recommended by many authors, some scholars involved in participatory research projects have started to conduct reflexive

works (Etienne 2011;Simon 2004). Large European projects provide good opportunities to conduct participatory research and reflexive analyses. However these reflexive analyses have mostly also focused on coarse grain level so far. They are rather at the scale of the whole process (Steyaert et al. 2007). Among these, Steyaert and colleagues analyzed the production, the transformation and the flow of knowledge during the entire research process. They point out the necessity of political frames in order to make explicit the role of scientist in a participatory research: providing knowledge, but also facilitating, and sometimes setting the goals for the interaction, due to the overarching importance of scientists' knowledge. Further, an analysis of case studies have shown an asymmetry among disciplines in their capacity to lead such participatory process in multidisciplinary or transdisciplinary setting (Charles et al. 2008). However, they did not go deeper into micro mechanisms to explain how knowledge is expressed, transformed, received, and interpreted. In a participatory process, stakeholders disclose potentially crucial information about themselves to others. This raises some ethical concerns regarding the intervention of scientists. Their work cannot be thought as a separate category of their object of work anymore due to their engagement in a participatory stance. The boundary between realm of management and realm of research is getting blurred. What is going through this boundary? How do interventions of one category modify relations on the other side?

2.3 As pointed out through the analysis of several participatory research dealing with adaptive water management on the basis of the FP6 integrated project NeWater, participatory research fits Ostrom's IAD framework (Ostrom 2005): knowledge happens to be a strategic shared resource which can take various status, specific participatory events can be analysed as action situations while a whole participatory process would be an action arena. Rules for driving knowledge production and knowledge use constitute the institutional framework, even though they are not always explicit. Using this framework has a triple benefit: (i) it makes explicit the overlapping between action arenas through sharing participants as well as the ambiguities about the status of knowledge as a shared resource, (ii) this framework is already used to understand the dynamics of water management as a shared resource, (iii) it is a framework which has already proved suitable for exploration by social simulation. Therefore even if it is not a framework coming from the field of Science and Technology Studies, we assume that it can help understanding the dynamics of knowledge production over the participatory border and its side effect on the management side.

An issue of knowledge flow

3.1 Representation of knowledge flows across this boundary is still a difficult question. Several works have already tried to represent pieces of knowledge as specific entities in the modelling of a system and its dynamics. The representation of knowledge flow processes has been developed in the field of innovation diffusions in the context of corporate businesses (Sorenson et al. 2006). This field focuses on stakes or actors involved. Although authors in this field mention the importance of the topology of relations among actors, they do not explore topologies, as structured as those we can find in participatory settings. They rather explore either random interactions within the population, or the existence of social networks. This trend displays interesting exploration of simulation models with an agent based simulation architecture (Pyka et al. 2007). Science studies provide interesting frames at a coarser grain. Steyaert and his colleagues propose a dual view on knowledge: a thing and a flow. However, they don't explicit their view on knowledge: how it is constituted, and how it is transformed at the nodes of the networks which serve of matrices for the flow (Steyaert et al. 2007). Also at the level of framing, with the "Way of Knowing" approach, Lejano and Ingram make the point of the interpretation of various pieces of knowledge within a political space in a dynamic way (Lejano and Ingram 2009). This means that current political context of a participant in a participatory research will frame his or her way of contributing and receiving what happens in a specific participatory event.

3.2 Representation of knowledge in the relation between scientist and policy makers is a little bit more characterised. In her comprehensive literature review, McNie describes knowledge according to 3 characteristics: salience, credibility and legitimacy. This means that knowledge produced by a scientist has to be delivered in the relevant scales and timing, suitable proofs of quality, and free of political biases (McNie 2007).

3.3 The other way to characterize knowledge is through its content. In a production oriented view, Sorenson and colleagues consider a piece of knowledge as a recipe, with ingredients, whose interactions make the final product when applying knowledge (Sorenson et al. 2006). This entails considering the complexity of a given piece of knowledge, and thus the difficulty to transmit it without irremediable errors.

3.4 At a finer grain, models of knowledge are represented with abstract vectors made of topics, with a more or less complicated structure (Parunak et al. 2009). In a recent agent based model of diffusion innovation, Pyka and colleagues consider a vector of "kenes", which are triplets made of domain of capacity, an ability to perform a project in that domain, and an expertise level in that domain (Pyka et al. 2007). These models implement agents with short-term memory, in order to give more weight to the diffusion among actors. This environment can be refined, and some knowledge on others can be added: Parunak and colleagues add a representation of others to give preferences to agents in the selection of other agents to interact with (Parunak et al. 2009).

3.5 Knowledge dynamics is then described through processes involving various sources of knowledge and/or processes involving observations on the "real" world. Once received, knowledge goes through a trial and error process (Sorenson et al. 2006). As far as innovation diffusion is concerned, knowledge is assessed according to what it made possible as new type goods. Hence, trial comes through the quality of the goods which may be produced according to the new pieces of knowledge acquired as well as to the financial benefits they may generate (Pyka et al. 2007). At the other extreme of the range, opinion dynamics models consider only opinion of others: an agent will incorporate opinions of others if it turns out being the opinion of a majority (Parunak et al.

2009). In this case the context, or the topology of the social system, is crucial to understand the subset of actors which will provide the opinions. Further, in their work regarding cognitive convergence, Parunak and colleagues consider a finite set of possible domain of opinions. They assume implicitly that actors who consider that a domain is not valuable know that this domain exists and that others may have a different opinion. This can't match systems with radical uncertainties (Funtowicz and Ravetz 1993;Pellizzoni 2003) such as those at stake in most participatory research situations.

🌐 Towards social simulation of knowledge flows in participatory research

4.1 Context plays also a role in reception of knowledge by policy makers at the science/policy interface. Jones identifies four conditions for an effective reception and integration of new knowledge: fitness to on going decision processes, compatibility with existing models and policy processes, accessibility for suitable policy makers, and receptivity of policy makers to research results (Jones et al. 1999).

4.2 This makes the issue of knowledge flows in participatory research an issue of situated action (Conein and Jacopin 1994;Suchman 1987) and windows of opportunity (Michaels et al. 2006): the knowledge and the questions put into the group of participants by scientists have to meet all these conditions. Even if case studies are not specifically oriented towards a specific issue to sort out within an ongoing decision process, participants are embedded in decision processes besides their involvement in the participatory research. Within the structure analysed as a suite of action situations (Ostrom 2005) and the frame provided by the specific setting (Dewulf et al. 2007), participants can handle some parts of their tacit knowledge, while other parts remain out of "hand" (Johannessen et al. 2001). In the situation of (inter)action, participants can be creative. Through the use of boundary objects, this creativity can grow among the collective, along 3 phases: seeding, evolutionary growth and reseeding (Fischer et al. 2005).

4.3 Finally a key limit in borrowing from knowledge diffusion processes in corporate business sector relies to the pro-activity of participants. Innovation implies an active search from each participant. Diffusion of knowledge relies mainly on the quality of the communication channel, i.e. on the proximity (social or spatial) between both ends of communication. The existence of such proximity is crucial to facilitate the good understanding of the knowledge transmitted, as long as its complexity falls in a medium range (Sorenson et al. 2006). This limit sets up some constraint for the modelling of knowledge diffusion in participatory setting: representation of action situation has to cover this attitude of active search of participants for new knowledge and the dynamics of proximity relations according to the evolution of interactions.

4.4 Therefore with our experience in social simulation and participatory processes, we suggest that the social simulation community takes this specific approach of knowledge production in participatory or collaborative settings as an object because of the ethical issues associated to it. What is the knowledge really produced, to the benefit of whom, and who could control the orientation of the process at tipping points. It can add to existing assessments of participatory research an understanding of their dynamics through "micromotives", those which are not necessary aiming at driving the participatory research process but which influence it because of their impact on the conditions for it to unfold. Existing social simulation of knowledge diffusion in business context, institutional frameworks to provide suitable categories at the interface of research and management, and behavioural patterns as situated action proposed by Science and Technology Studies trends constitute a theoretical basis to deal with social simulation of participatory research. Existing description of past participatory research such as those done by the Companion Modelling group (Etienne 2011) or recent EU projects can provide the empirical basis. These have actually started this work with an initial conceptual prototype of a companion modelling process for example (Barreteau et al. 2011). However they are mainly based on a reflexive stance which needs now an external point of view to strengthen the formal description of a participatory research process.

🌐 References

BARRETEAU, O, Bots, P W G & Daniell, K A (2010). A framework for clarifying "participation" in participatory research to prevent rejection of participation for bad reasons. *Ecology and Society* 15, (2) art 1 http://www.ecologyandsociety.org/vol15/iss2/art1/.

BARRETEAU, O, Bots, P W G, Daniell, K A, Etienne, M, Perez, P, Barnaud, C, Bazile, D, Becu, N, Castella, J-C, Daré, W & Trebuil, G (2012) Participatory approaches and simulation of social complexity. In EDMONDS, B & MEYER, R (Eds.) *A Handbook on: Simulating Social Complexity.* Springer.

BARRETEAU, O, Bousquet, F, Etienne, M, Souchère, V & d' Aquino, P (2011) Companion modelling: a method of adaptive and participatory research. In ETIENNE, M (Ed.) *Companion Modelling. A participatory approach to support sustainable development.* Versailles, France: QUAE.

CHARLES, M, Chlous-Ducharme, F, Faugère, E & Wintz, M (2008). Science et Démocratie dans la Gestion de la Nature : des ethno-sociologues pris dans la modélisation d'accompagnement. *Vertigo* 8, (2) 17 http://vertigo.revues.org/4999.

CONEIN, B & Jacopin, E (1994). Action située et cognition. *Sociologie du Travail* 94, (4) 475-500

CORNWALL, A & Jewkes, R (1995). What is participatory research? *Social Science & Medecine* 41, (12) 1667-1676

[doi:10.1016/0277-9536(95)00127-S]

DEWULF, A, François, G, Pahl-Wostl, C & Tailleu, T (2007). A Framing Approach to Cross-disciplinary Research Collaboration: Experiences from a Large-scale Research Project on Adaptive Water Management. *Ecology and Society* 12, (2) 14 [online] http://www.ecologyandsociety.org/vol12/iss2/art14/.

ETIENNE, M (ed.) (2011) *Companion modelling. A participatory approach to support sustainable development*, Versailles, France: QUAE.

FISCHER, F (1993). Citizen participation and the democratization of policy expertise: From theoretical inquiry to practical cases. *Policy Sciences* 26 165-187 [doi:10.1007/BF00999715]

FISCHER, G, Giaccardi, E, Eden, H, Sugimoti, M & Ye, Y (2005). Beyond binary choices: integrating individual and social creativity. *International Journal of Human-Computer Studies* 63 482-512 [doi:10.1016/j.ijhcs.2005.04.014]

FUNTOWICZ, S O & Ravetz, J R (1993). Science for the post-normal age. *Futures* 25, (7) 739-755 [doi:10.1016/0016-3287(93)90022-L]

JOHANNESSEN, J-A, Olaisen, J & Olsen, B (2001). Mismanagement of tacit knowledge: the importance of tacit knowledge, the danger of information technology, and what to do about it. *International Journal of Information Management* 21, (1) 3-20 [doi:10.1016/S0268-4012(00)00047-5]

JONES, S A, Fischhoff, B & Lach , D (1999). Evaluating the Science-Policy Interface for Climate Change Research. *Climatic Change* 43 581-599

LEJANO, R, P. & Ingram, H (2009). Collaborative networks and new ways of knowing. *Environmental Science & Policy* 12, (6) 653-662 [doi:10.1016/j.envsci.2008.09.005]

LEVREL, H, Etienne, M, Kerbiriou, C, Le Page, C & Rouan, M (2009). Co-Modeling Process, Negotiations, and Power Relationships: Some Outputs From a MAB Project on the Island of Ouessant. *Society and Natural Resources* 22, (2) 172-188 [doi:10.1080/08941920801985817]

MCNIE, E C (2007). Reconciling the supply of scientific information with user demands: an analysis of the problem and review of the literature. *Environmental Science & Policy* 10, (1) 17-38 [doi:10.1016/j.envsci.2006.10.004]

MERTENS, F, Saint-Charles, J, Mergler, D, Passos, C J & Lucotte, M (2005). Network Approach for Analyzing and Promoting Equity in Participatory Ecohealth Research. *EcoHealth* 2 113-126 [doi:10.1007/s10393-004-0162-y]

MICHAELS, S, Goucher, N P & McCarthy, D (2006). Policy Windows, Policy Change, and Organizational Learning: Watersheds in the Evolution of Watershed Management. *Environmental Management* 38 983-992 [doi:10.1007/s00267-005-0269-0]

OSTROM, E (2005) *Understanding Institutional Diversity,* Princeton, Princeton University Press.

PARUNAK, H V, Belding, T C, Hilscher, R & Brueckner, S (2009) Understanding Collective Cognitive Convergence. In DAVID, N & SICHMAN, J S (Eds.) *MABS 2008, LNAI 5269.* Berlin, Germany: Springer-Verlag.

PELLIZZONI, L (2003). Uncertainty and Participatory Democracy. *Environmental Values* 12 195-224 [doi:10.3197/096327103129341298]

PYKA, A, Gilbert , N & Ahrweiler, P (2007). Simulating Knowledge-Generation and Distribution Processes in Innovation Collaborations and Networks. *Cybernetics and Systems: An International Journal* 38 667-693 [doi:10.1080/01969720701534059]

SIMON, S (2004). Systemic Evaluation Methodology: The Emergence of Social Learning From Environmental ICT Prototypes. *Systemic Practice and Action Research* 17, (5) 471-496 [doi:10.1007/s11213-004-5789-7]

SORENSON, O, Rivkin, J W & Fleming, L (2006). Complexity, networks and knowledge flow. *Research Policy* 35 994-1017 [doi:10.1016/j.respol.2006.05.002]

STEYAERT, P, Barzman, M, Billaud, J-P, Brives, H, Hubert, B, Ollivier, G & Roche, B (2007). The role of knowledge and research in facilitating social learning among stakeholders in natural resources management in the French Atlantic coastal wetlands. *Environmental Science & Policy* 10 537-550 [doi:10.1016/j.envsci.2007.01.012]

SUCHMAN, L A (1987) *Plans and situated actions: the problem of human-machine communication,* Cambridge University Press.