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Shifting and Deepening Engagements

Experimental Normativity in Public Participation in Science and Technology

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Abstract

Public participation in science, technology, and innovation is a significant trend in contemporary western democracies, which increasingly implicates the social scientist in diverse ways. Yet, the question as to how social scientists actually engage in public participation, and how their engagements may be normatively justified, is not the object of systematic consideration in participatory frameworks and in action-oriented social science. In this article, we ask how social scientists can take responsibility for their normative choices when engaging in participatory practice. Drawing on our experiences as researchers of public participation in nanotechnologies in Flanders (Belgium) and France, respectively, we reflectively consider our relationship with research subjects, the political relevance of our work, and the research problems we deal with. This leads us to articulate three modes of normativity that inform our commitments: a process mode, a critical mode, and a mode inspired by Actor Network Theory. Differentiating between these modes and garnering sensitivity towards each mode's characteristics opens the way to experimentation with different types of normativity through which the social scientist accounts for his commitments and shifts or deepens his engagements in response to conflicting demands and real-world circumstances. Thus, rather than endorsing one approach to participation, we recommend a pragmatic attitude that implies systematic probing of the roles the social scientist assumes vis-à-vis other participants, interests, and objectives, and that enables him to continually adjust his position in view of the particularities of his situation.

1 Introduction

"The integration of ethical concerns, innovation research and social sciences into nanosciences and nanotechnologies Research and Development will help build confidence in decision-making related to the governance of nanosciences and nanotechnologies." (CEC 2005: 9)

Public participation in science and technology (S&T) is a significant trend in contemporary western democracies, which engenders new research collaborations and the building of new relationships between science and society. Yet, despite the widespread adoption of participatory discourses and practices, the terms and uses of "participation" are manifold and contested. In this article, we reflect on our engagements as social scientists in ongoing processes of public involvement in new and emerging technologies. The questions we raise concern the shifting nature of roles (expert-non-expert, observer-participant), the interplay of different "knowledges" (scientific, sociological, lay) in participatory processes, and social researchers' contributions to innovation and research and development more broadly, as policy makers, natural scientists, and citizens call on us to take on responsibilities beyond the traditional confines of academia. The quote above from the European Commission's nanotechnology Action Plan is a case in point, as it proposes integrating social sciences into nanotechnology research and development in order to build public confidence in nano-related decision-making. Yet, the extent to which social science can contribute to this aim, and whether or not it should, is debatable. More challengingly still, assuming that social scientists accept the invitation to play a role in the governance of emerging technologies, how are they to proceed?

These questions are further complicated by the fact that social scientists themselves increasingly instigate and coordinate participatory activities in S&T, for instance through consensus conferences and scenario workshops. This is distinctively the case with new and emerging technologies, where social researchers mobilize citizens and natural scientists in experiments with "anticipatory governance" (Barben et al. 2008) and provide participatory expertise in potentially controversial contexts (Joly and Kaufman 2008). Often, these initiatives assume a scope, reach, and aims that differ from policy rationales. They can also differ considerably from one another.

The multiplicity of engagement formats and the variety of expectations and demands they entail, produces contradictions and uncertainties that are normative and political in character, as actors seek both to justify and prescribe particular lines of action for others to follow, and organize themselves for mutual support. As these processes invariably implicate the social scientist in various ways, there is a need to empirically examine and conceptually frame the forms of engagement he enacts (Macnaghten et al. 2005, Bennett and Sarewitz 2006). Thence, we ask ourselves how we relate to policy makers, citizens, natural scientists, and other social scientists in public participation. How should we engage with these actors and how should we study them? Under which conditions and on which grounds do we act? More broadly, how do we understand the political and normative significance of our work?

In the field of Science and Technology Studies (STS), in which our research is situated, the questions posed above prove contentious. Critics argue that STS research fails to transform the ways in which science is done (Fuller 2000) and that it cannot help us in answering the pressing political question, What to do? (Radder 1998). While prominent STS scholars respond that their work is "political in the deepest sense" (Jasanoff 1996) as well as critically engaged, for instance because it

renders explicit competing claims in the production of rationality (Wynne 1996), these responses by and large leave open the question of how the social scientist is to articulate normative positions or state claims vis-à-vis the actors he engages with.

Recently, advances in addressing questions of this more explorative nature have been made, as STS analysts reflexively attend to the multiple and potentially conflicting roles they assume in technoscientific collaborations (see e.g. Abels 2009, Doubleday 2007, Burchell 2009, Robinson 2010) and ask what it means to intervene in practice as an STS researcher (Zuiderent-Jerak and Jensen 2007). Increased attention is also given to the different ways in which STS scholars conceptualize technology, politics and participation, and to the political implications of using these concepts in particular ways (Wynne 2007, Nahuis and Van Lente 2008). Acknowledging, and responsive to, these tendencies in STS, this article is meant as a contribution to the growing body of literature that develops critically reflexive analyses of STS, often with the benefit of ethnographic data, and questions the roles of social scientists in relation to public participation in S&T in particular.

Our questions and concerns lead us to interrogate the reflexivity of the social scientist. Reflexivity, as it is deployed in this article, implies calling attention to the social scientist's research and the practices he engages in. As we seek to illuminate normative aspects of social science research in particular, we ask how the researcher relates to the actors he studies, how his work is politically relevant, and what kinds of research problems he deals with. Our use of the term is not to be confused with calls for reflexive analysis in anthropological and sociological literature, which demand that social scientists make explicit their normative commitments by accounting for the funding they receive and how their work is mobilized, for instance.[1] While such questions can be normatively and politically relevant, they are often asked with the aim of ensuring both the neutrality of the social scientist and the accuracy of his descriptions. Consequently, they fail to consider how representation and object of study are interdependent (Woolgar 1988).

Nor do we propose continuous questioning of the social scientist's position and interpretations to the extent that he becomes an ethnographer of his own involvement practice. While "constitutive reflexivity," as this kind of reflexivity is called (Woolgar 1988), can help to render explicit what social scientists take for granted about their experiences and interpretative practices, it provides them with little in the way of practical resources. We concur with Latour (1988a) that relentless probing of one's own interpretations, knowledges and positions comes with the risk of being trapped in a "reflexivity loop" that restricts opportunities of becoming politically engaged. Thus, rather than disengaging from our research in order to interpretatively account for it, we seek to develop a strong capacity for practical action, which is nonetheless steeped in reflection.

In order to account for the different features of normativity that confront us, we distinguish three different modes of normative engagement that inform our researcher commitments: a process mode, a critical mode, and a mode inspired by Actor-Network Theory. Each of these modes constitutes a coherent expression of three dimensions that define social scientific activity: (1) the relationship of the social scientist with the actors he studies, (2) the political relevance of his work, and (3) the problem the social scientist

[1] For anthropology, see e.g. (Clifford and Marcus 1986). In sociology, Bourdieu (1980) has called for "objectifying the objectification."

deals with. Upon comparing our responses along each of these dimensions, we contend that it is the ever-changing and fluid interplay among modes that may fruitfully inform our future actions, as we shift between modes or deepen a particular approach with respect to a given context. In an attempt to offer ways to think about and handle the multiplicity of normative commitments, we propose the notion of experimental normativity, which we ground in classical pragmatism. More than a mode, experimental normativity is a pragmatic attitude towards engagement that implies systematic probing of the roles and contributions social scientists assume throughout their engagements. As such, it is an attempt at empirical exploration of how the social scientist may articulate various normative positions or state claims vis-à-vis the actors he studies whilst he engages with them in ways that he believes are meaningful and responsible, and thus sufficiently reliable to inform his future actions.

2 Two trajectories through participation

As our accounts suggest, public participation in nanotechnologies is particularly instructive to examine and rethink social researchers' roles and commitments, as these technologies are still at an early, undetermined stage of development. Hence, they open a space for collective exploration and enactment, which implicates diverse actors (citizens, scientists, and social researchers) and topics (ranging from safety and risk concerns to governance issues) in unprecedented ways. In the two cases described in this article, collective exploration is made possible by means of formal, well-structured group dialogue, such as a citizens' panel or a "Nanoforum" involving innovation actors and societal groups. The two cases also have in common that participatory initiatives often receive financial support from state bodies, or are at the very least lauded by policy makers in Flanders and France, respectively, as a means of furthering socially responsible innovation. Yet, despite this shared public endorsement of participatory mechanisms and despite significant overlap as to whom these mechanisms engage and how they are structured along participatory lines of inquiry, different problems and challenges surface in the interactions between participants and different kinds of discussion ensue. Accordingly, our responses as social scientists to the situations we encounter differ, and in fact lead us to ponder the kinds of questions participants are asked in the first place, to which ends they are asked these questions, and whether and how we can develop other framings of the issues, questions, and relationships at hand.

2.1 Author 1: From process to critique

I became involved in public participation in S&T as a social science researcher to the Flemish participatory Technology Assessment (pTA) project "Nanotechnologies for Tomorrow's Society" (NanoSoc). Although I had little knowledge of pTA at the time, I was intrigued by the idea of inviting outsiders to nanotechnology to participate in its development and sympathetic to the project's aim of initiating dialogue events between scientists and publics (I was also looking for a job). Initially, I engaged in the project as an "observing participant"; i.e. as one of the social scientists who contributes directly to the endeavor by initiating participatory workshops, conducting interviews with experts, collecting and analyzing data, and writing up reports. In a later stage however, I switched to the role of "participant observer," leading me first and foremost to observe and analyze actors' interactions in the project without actively bringing in my own perspective. This was shortly after I obtained a research grant that permitted me to do research more or less independently from NanoSoc.

My reasons for tentatively moving away from the project and the implications of doing so are elucidated below. Before turning to my experiences however, I should further qualify my understanding of "participant observer" as opposed to "observing participant," as the duality between the two positions informs my commitments. Participant observation, as I intend it, signifies an inclination towards detached analysis that emphasizes observation rather than participation, albeit without denying that the two are inextricably intertwined, as the observer cannot remove his observational traces. Similarly, detachment does not imply that the researcher has no normative commitments or social location; rather, it signifies an intention to a posture of non-alignment that brings "serious, sympathetic and critical attention to claims" as these are described into reality (Taves 2003). The distinction is an important one to make, as my intention to restore a distance with participants is largely at odds with the role many participatory approaches designate to the social scientist, particularly those that conceive of data generation and data interpretation as a joint enterprise to which all contribute through "co-operative inquiry" (Heron 1996, Reason and Bradbury 2001). NanoSoc is but one of many pTA formats that draw on this cooperative, action-oriented research paradigm. The language of "co-construction" that it speaks suggests that each actor has a stake in shaping technology and that everyone may be engaged in its crafting through a process of mutual learning. This also includes the social scientist, who is attributed the multiple responsibilities of initiating, facilitating, and analyzing participatory processes towards "socially robust" outcomes (Goorden et al. 2008a). Yet, one of the most obstinate problems I have faced is precisely how to combine these different roles, especially in instances where they tend to rule each other out. Hence, I have sought to come to terms with the methodological, political, and relational struggles I have experienced through the language of co-construction and questioned the feasibility of aligning initiation, facilitation, and analysis.

Questioning the smart environment

In 2007, social scientists in NanoSoc initiated a three-round Delphi study to which nanoscientists, "social experts,"[2] and citizens were asked to contribute short stories on the future of a smart environment with nanotechnologies. The aim of the study was to incite reflection on potential futures with "nano" in Flanders, taking participants' visions and expectations as a starting point. Social scientists initiated and facilitated the rounds and also analyzed participants' contributions by drawing out recurrent themes in the stories, assessed which actors and institutions were attributed which responsibilities, etc., but did not contribute narratives themselves. What struck me was how the vast majority of contributions depicted technology users as highly autonomous and responsible consumers who are free to choose. Respondents envisaged consumers using smart gadgets such as intelligent fridges, "personal digital assistants," intelligent underwear, and electronic labels on luggage in order to save themselves time, money, and frustration. Questions as to what causes time stress and frustration and how technology may incite anxiety were overlooked. Hence, I raised these questions in a popular science magazine editorial (Van Oudheusden 2007).

My urge here was to unearth assumptions about human needs and psychology that are built into actors' views on technologies, as well as to bring in voices not easily heard that

[2] This category comprised social scientists from other departments and universities than ours, scientists in the liberal arts, in philosophy and the humanities, and various types of professions, such as journalists, politicians, and contemporary artists.

question common sociotechnical presentations. I saw a role for the social scientist in discerning forms of critique not readily provided and that were therefore not taken into account. As such, I also implicitly questioned the disposition of the social scientist in NanoSoc towards facilitation and analysis rather than (direct) engagement. In a report that followed the Delphi study, I argued that we were to give more consideration to questions about assumptions, norms, and expectations in the ensuing phases of the project, specifically given the aim of interactive TA (as I labeled the project at that time) of "moving beyond self-containing perspectives and recursive practices that characterize a certain policy field or technology domain" (Loeber 2004) (Van Oudheusden et al. 2007).

Principlism versus narrative ethics

To some extent, deeper issues about the smart environment surfaced in the following NanoSoc phase, which consisted of three citizens' panels of fifteen participants each.[3] Panelists were asked to reflect on the nanotechnology futures that emerged in the first NanoSoc round, with the aim of inciting debate about potential developments, whether positive or negative. To make the workshop as concrete as possible, the NanoSoc research team had selected two scenes from the "nanofutures" in advance. These scenes were acted out by a professional actor and by participants themselves through role-playing. Questions laid out to the panelists included the following: How do the future worlds enacted in these plays differ from the ways in which you live and work today? How are they similar? What role does technology play in these future worlds? Which values are at play in these future worlds? Hence, the aim of the citizens' panels was to engage citizens in fictive worlds to make explicit the values depicted therein and to have participants reflect on the changing nature of values over time.

Shortly after the panel workshops, an issue of contention arose between social scientists as to how to analyze participants' contributions. As the aim was to draw out citizens' values in relation to nanotechnologies, a discussion ensued on whether to adopt a "principlist" approach, which assumes that four overarching principles are central to moral life and which organizes all values in relation to those principles, or a narrative ethics, which stresses the relational and communicative dimensions of moral situations (McCarthy 2003).[4]

As with the Delphi study, I felt more inclined towards exploring citizens' argumentations and challenging their views and norms, rather than attempting to organize moral beliefs and commitments according to predetermined principles. In a paper I wrote with a colleague shortly after this research phase, I argued that a narrative approach would provide a richer appreciation of citizen values, as it has the potential to reveal the framings that produce claims rather than only considering whether there is agreement or disagreement between them. To give an example, participants in the citizens' panel on smart environment defined the overarching principle of autonomy both as a value and a disvalue, depending on the situation at hand. One respondent argued that our increasing dependency on technology *enables* us to act independently (i.e. as free agents), as well as *disables* us to make decisions consciously and willfully without reliance on technology. Another respondent suggested that technology drives our need to become autonomous. Yet, the social situatedness of autonomy/dependency and the

[3] Criteria for selection included gender, age, socioeconomic status, work and educational background.

[4] More specifically, social scientists in NanoSoc deployed an ethical matrix, adapted to nanotechnologies.

extent to which it generates ambiguous responses to technology, received scarce attention in the initial principlist organization of the data.

Furthermore, principlism itself performs certain assumptions of what a citizen is, makes a distinction between the social and the personal, and between the human and the technological. While these distinctions may well be necessary for participants to make sense of nanotechnology, I felt they ought to be debated. So my aim was not simply to discern values as if these corresponded directly with the data citizens provided us with, but to reveal some of the process of gathering and analyzing data itself by showing that a principlist approach purifies away instructive nuances. However, I also wondered whether a participatory framework that seeks to instigate harmonious co-construction permits delving into potentially controversial issues and differences between participants.

Disrupting participation: critical normativity

One may discern from the examples above a principle of inquiry in NanoSoc that orients actors' contributions towards common action and solutions (e.g. an assumed common morality). Like pTA formats in general, procedures in NanoSoc are normatively grounded in a commitment to deliberation and consensus seeking (e.g. Sclove 1995, Hamlett 2003). More specifically, pTA formats seek to initiate a process of co-management (or co-construction) of technology to which various actors contribute their views and concerns so that widely supported outcomes may be obtained. Within this perspective, instigating an inclusive, accountable, and transparent procedure matters as much as, or more than, the technological outcomes themselves (Nahuis and Van Lente 2008).[5]

Hence, the political relevance of the social scientist in pTA lies in elucidating processes that meet these criteria, which he sees as a prerequisite to producing more robust sociotechnical systems. The core problem he deals with is evaluating the processes or design mechanisms that produce systems on those terms, usually with the intention of transferring the acquired knowledge to other settings and contexts.[6] Table 1 summarizes this process mode of normative engagement.

Table 1: A process mode of normative engagement

Relationship of the social scientist with the actors he studies	Co-researcher or co-practitioner
Political relevance of social scientific work	Elucidating processes that produce more robust sociotechnical systems
What is the problem the social scientist deals with	Evaluating process or design mechanisms

Without denying the importance of devising more inclusive procedures for sociotechnical decision-making, my

[5] This emphasis on procedure does not imply that the substantive results of TA practice are irrelevant. Schot (2001) for instance argues that Constructive TA (CTA), which is linked to pTA, "is based on the assumption that CTA practices will eventually … produce outcomes more widely acceptable, with fewer adverse effects." Nonetheless, pTA formats foreground the interaction between actors and the mutual exchange of viewpoints.

[6] In NanoSoc, the attempt to transfer procedural knowledge is implied in its mission: "The main objective of the research project Nanotechnologies for tomorrow's society (NanoSoc) is to develop and try out an interactive process as a methodology in support of (nano)scientists and technologists when trying to incorporate societal expectations and issues as regards strategic research decision making" (Goorden et al. 2008b).

experiences in NanoSoc lead me to say that a firm commitment to co-inquiry has far-reaching political and epistemological implications that remain unaccounted for. For one, "pTA researchers may be too preoccupied with accommodating various perspectives into a shared framework of action (...), thence leaving alternative and new understandings of notions unexplored" (Van Oudheusden 2011). In the first example above, dominant notions of smart environment remained unchallenged in the interactions between participants. Moreover, when all actors are involved in decisions about content and method, as the co-inquiry paradigm in its fullest form insists, critical questions as to whose assumptions define the smart environment and how it is deliberatively established remain not just to be answered, but need first to be recognized as significant. Complementary to this political argument, one could argue that a critical assessment of actors' assumptions is a necessary (albeit far from sufficient) condition to incite a collective learning dynamic, as it requires actors to recognize and articulate their interests, concerns, and identities in view of competing understandings, possibly even moving them to revise their assumptions in the process (Wilhelmson 2002, Rip 1986). Lastly, one may question the disposition of the social scientist in NanoSoc in that he inevitably does set himself apart from participants, not just by abstaining from debate in participatory events (as in the Delphi exercise), but also upon designing the project's data-gathering methods and extracting interpretations through them. My contention here is not that this disconnection sits uneasily with the principle of inclusiveness that is central to co-inquiry as such, but that it brings problems of ownership, control, and power that remain unaddressed if the distinction is not acknowledged.

The ramifications and inconsistencies I discern in the participatory approach explain my shift towards a critical mode of normative engagement that interrogates the assumptions, procedures, and techniques that sustain NanoSoc and pTA at large, and that is more detached than participatory in character. Interrogation, as I see it, may be achieved by setting up contradictions (principlism versus narrative ethics) and creating differences (searching for differentiation rather than agreement) that disrupt conventions, codes, and principles. At best, critical analyses of this type produce translations between different registers that allow interruptions to the norm, for instance by taking the form of a principlist value assessment that is reflectively considerate of the discriminating work it necessarily performs, and to some degree even inclines towards narrative ethics. Hence, these interruptions may generate alternatives alongside dominant practices. They become discourses that do not favor one account over another, but open up the possibility of difference.

Table 2: A critical mode of normative engagement

Relationship of the social scientist with the actors he studies	Critical distance (detachment)
Political relevance of social scientific work	Disrupting disciplines so as to open up spaces for alternative configurations
What is the problem the social scientist deals with	Providing criticism based on an interrogation of received views and commitments

The critical mode I have sketched out is summarized in table 2. Although it is not new in terms of the methodologies it deploys and the normative commitments it implies (in both respects it draws on the writings of Foucault and certain strands of STS itself; see e.g. Law 2004, Stirling 2008), I would argue that it remains to be fully enacted in relation to pTA practices and tech-

niques. In the case of NanoSoc my interventions have incited debate among social scientists on questions of method and data gathering, on the relationships between project initiators and other parties, as well as on how to imagine and articulate the desired ends of the project. One nanotechnologist has repeatedly debated these questions with me as well, suggesting that in the interest of collaboration more time should be devoted to discussing with all participants the various theoretical frameworks and operational terms upon which a pTA rests.

It is important to recognize that the process mode and critical mode enact different concerns and interests that are by their very character difficult to draw together (e.g. the first is distinctively problem oriented, whereas the second values critique of modes and actions). It is therefore probably inevitable that deconstructing participation in the manners described weighs on my relationships with colleagues and with project participants who assume shared problem definitions, or are eager to establish them in the interest of moving the project forward without delving into normative concerns. The bigger question to my mind, however, is whether and how the tensions and conflicts between social scientists and their "normativities" can somehow be productive. This point is addressed in the following section by way of other empirical examples, and picked up again in the conclusion.

2.2 Author 2: Experimenting with mediation

Over the past few years, I have been studying a French civil society organization by the name of Vivagora, which campaigns for the "democratization of science and technologies." Created by science journalists in 2003, Vivagora has been particularly active in the field of nanotechnology. The association has organized public debates on nanotechnology, as well as intervened in public events organized or commissioned by the French government. Due to its alignment with civil society and the expertise its members bring to the table, Vivagora is a relevant case to examine –one that opens a third mode of normative engagement.

Vivagora's initial initiatives included two series of public nanotechnology meetings (in Paris in 2005 and Grenoble in 2006). As my research focused on sociotechnical controversies and public participation, the organization quickly became one of my objects of study. In one of several papers, I describe how Vivagora articulates a vision of public participation that calls for the collective production of robust sociotechnical systems (Laurent 2007). Vivagora equally took an interest in my research and came to contact me on a more regular basis. However, as I gradually became more implicated in Vivagora activities, I was led to question the nature of my engagement with the organization. I consider here some examples to illustrate different ways in which I negotiated relationships with Vivagora members, and thus the political relevance of my work as a social scientist.

Part of my research relates to the study of technological controversies in the field of ethics and the extent to which different forms of ethics produce different political arrangements. In a 2010 article, I describe a pragmatist ethics that does not accept stabilized boundaries between a factual reality that can be assessed and values that are then mobilized to judge it normatively (Laurent 2010). I argued that Vivagora articulates such a pragmatist ethics; a point the organization's administrator took note of and subsequently used to articulate her own position in a roundtable she was invited to. So in this instance, although the civil society organization was clearly an actor I was studying, my academic work enabled one of its members to more clearly state her position. My research thus contributed to "giving

voice," so to speak, to one of the actors under study.

Giving voice is a long-term concern of feminist studies that seek to expose the oppression of women in politics, science, art, etc. and do away with gender discrimination (Gorelick 1991). The use of this expression in terms of empowering dominated social groups has led to a somewhat romantic understanding of what it means (Rip 2000). Yet my interactions with Vivagora imply more than a desire to make heard the voices of those with fewer resources, be they financial, organizational, cognitive, etc. First, Vivagora does not need me to be heard – even if I occasionally manage to help the organization. Second, giving voice in this case is not just a matter of circulating existing positions that actors are supposedly not aware of themselves, as another example may illustrate. The Citizen Alliance on Nanotechnology Issues (ACEN), which was launched in 2010 following an initiative by Vivagora, was expected to coordinate the work of several civil society organizations in nanotechnology and gather information about risk research and governance formats. As the project constituted an empirical site in the production of the public of nanotechnology, I professed my interest in ACEN in my conversations with Vivagora members, who then called for my help as a "content expert" in the field of nanotechnology. As part of the work of the alliance was to gather information, content expertise amounted to advising what sort of information is to be acquired. The project could therefore be seen as an emerging collective exploration: of the social to be enacted, of the identity of the civil society organization itself, of my own position in the process, of what it means to have knowledge of nanotechnology. Giving voice here thus implies collective experimentation with the concerned actors.

A third reason why giving voice, in the sense of empowering actors, is insufficient to account for my work with Vivagora, is that the relationships are less one-way processes than constant interactions and adjustments, which require work from both sides. In some instances, these adjustments went smoothly so that empirical research and political involvement could come together in the same movement. A case in example is the Nanoforum, a participatory mechanism supported by the French Ministry of Health in which Vivagora also participated. In this instance, I was asked to stand in the organizing committee on behalf of Vivagora when the administrator felt she needed someone to accompany her to meetings. I agreed to do so and explained to her that I wanted to consider this site as an empirical object of study. Yet, in the course of my involvement, I gradually engaged in discussions about potential topics for the forum. For instance, I insisted on political instruments like nanoparticle labeling, as I believed such instruments to be good entry points through which pluralist political processes gain footing. In the somewhat informal organizing committee (in which other academics were also present and which did not have the rigid nature of a long-standing administrative body) I could negotiate the specificities of my position as both a member of Vivagora and as an academic and feel comfortable with the research setting I was a part of.[7] Through my involvement, the forum evolved, as did Vivagora, which now focused less on organizing public meetings than on the collective monitoring of nanotech research. To give an example, in early 2010 Vivagora launched a project on collective expertise, which drew in several civil society associations to jointly examine existing scientific literature and regulation on the use of nano titanium dioxide

[7] I appear as co-author in a paper written by the members of the organizing committee of the Nanoforum (Dab et al. 2009). I also use this example in my academic work.

and nano silver coatings. Initiatives as these in turn shaped the research I was doing. In taking a more explicit interest in how participatory mechanisms and devices are experimented with to answer complex, controversial or elusive public issues, I sought to answer how through experimentation "the citizen," for instance, is redefined or potentially transformed.

The relative ease with which I spoke with/for actors in Vivagora does not necessarily translate to other situations, however, especially when more traditional forms of representation are expected. Consider the following exchange between Vivagora's administrator, M, and myself:

> M: We're looking for someone to represent Vivagora at the meeting with DGCCRF (a French administrative office).
> L: I don't know if I feel comfortable doing this… I don't think I can advocate for Vivagora's positions.
> M: That's always the problem with you academics… you know, we want to be in action. (…) You should take more responsibility in the association.
> L: As I see it, I can contribute in my own way…[8]

In this instance I refused to participate on the official terms set by the administrator. The example indicates that the nature of the relationship is permanently at stake and needs to be explored through constant negotiations in which what is negotiated is itself in question. One can use the term "trial" here to describe the multiple situations in which uncertainty about the relative identities of the analyst and the actors is collectively explored (Latour 1988b). These relationships cannot be defined ex ante, as it is only through successive trials that they can be enacted. Hence, I cannot say in advance how I will position myself.

Giving voice and negotiating a position

In the work I do with Vivagora, giving voice is thus part of the job, in the sense that I believe my work contributes to making the actions of the organization more visible. As stated earlier, making the work of actors visible is not just a matter of rendering explicit existing positions. Rather, it implies using my own repertoires to bring new, previously non-existent realities to life.

To further elaborate this point, I turn to Actor-Network Theory (ANT). In an ANT perspective, enactment is a central issue and concern to the sociologist. Callon uses the example of his work with the Association Française contre les Myopathies (AFM) to demonstrate how his involvement contributed to the organizational evolution of the AFM through its explicit recognition that it could make a relevant contribution to scientific research (Callon 1999). As this example indicates, the nature of the social scientific contribution is to be found in the collective formation of social and technical identities, which entails articulating social identities not previously considered or clearly formulated beforehand, as well as participating in the construction of sociotechnical concerns (e.g. genetic treatment of a rare disease). The social scientist is attached to specific actors in this process, through which he enacts the social (Law and Urry 2004) and produces his own subjectivity (Gomart and Hennion 1998). He contributes to the stabilization of heterogeneous arrangements, which consist of political commitments (e.g. the definition of a public concern), value judgments (e.g. the choice to mobilize for a particular issue), and material devices (e.g. the layout of a participatory format). The collective exploration in my study of Vivagora and my interactions with the organization can be described as an ongoing process of enactment: both the members of Vivagora and I experiment with our social identities. Concretely, enactment comes about through the organization of participatory activities such as the Nanoforum,

[8] Phone conversation, October 16, 2008 (my translation).

and mutual attempts to transform sociotechnical concerns (such as nanoparticle labeling) into public issues. Practicing sociology then, is considered both a methodology for the social scientist and a form of action in the world that is always relational and process-oriented. Callon (1999), for instance, speaks of successive attachments and detachments to describe his work with actors, thus implying that there is not one, fixed relationship between the researcher and his research subjects. On the contrary, moments of proximity should alternate with distancing episodes. Yet, articulating attachments and detachments is clearly not easy or straightforward. My own experience with Vivagora demonstrates some of the difficulties it entails. The dialogue quoted above can be read as an example where my attempt to detach myself from certain actors is met with reluctance on both sides, as I am pressured into an engagement that I do not believe in or wish to advocate. It demonstrates that remaining attached and detached requires permanent adjustments with the actors in question and has to be tested and made more robust each time it is subjected to trials.

In this perspective, the difference the social scientist seeks to make in the world is interwoven with the forms of the links with the actors he studies. In the process of enacting associations, social scientists ideally act as mediators between different worlds. Contrary to intermediaries, mediators transform the social while they circulate among actors (Latour 2005: 39). The methodological position of the mediator as described by ANT goes with individual choices the social scientist makes as an academic researcher. His choices lead him to follow certain associations rather than others, providing resources to certain actors (those he studies), as much as they provide resources to him (Callon 1999).

An ANT derived mode of normative engagement

One can thus identify a mode of normative engagement derived from ANT, which appears relevant to account for some of the interactions with the actors I study and the form of normativity I articulate. The political relevance of this mode is to be found in the process of making associations visible and explicit, in ways that also render visible to the world his own descriptions and analyses. The problem the scholar addresses is which association he wants to study, and thereby enact. In this mode, the social scientist acts as a successively attached and detached mediator. Table 3 summarizes the mode of normative engagement as derived from ANT.

Table 3: An ANT derived mode of normative engagement

Relationship of the social scientist with the actors he studies	A mediator successively attached and detached
Political relevance of social scientific work	Making associations visible, thereby enacting them
What is the problem the social scientist deals with	Choosing emerging associations to study

As my above experiences in the field of nanotechnologies suggest, it is not clear what the issues are and how they are to be dealt with, or what the roles are of social movements like Vivagora and those of researchers like me. Clearly, while public participation in nanotechnologies is still in the making, there is room for exploration and collective enactment. Accordingly, as it is at times difficult to ensure the necessary openness in the relationships with the actors under study, there is a need to refine understandings of experimentation, enactment, and mediation based on everyday practice and struggles with normativity.

Accounting for trajectories across modes

Based on our experiences as social scientists with participation in S&T, we encountered a process mode, a critical mode, and an ANT-derived mode. Although these modes are prominent in our research field, we do not contend to have described the entire landscape of normative positions. Rather, we have sought to account for a variety of positions the social scientist adopts when he circulates among the actors he studies or "moves about" (Rip 2000).

The two previous cases therefore describe trajectories, which the social scientist enacts. In the first example, the analyst is involved in a participatory project to which he adopts a mode of normative engagement based on knowledge he acquires in the process. He shifts to a critical mode that allows him to make explicit issues not articulated by the involved actors, specifically the politics embedded in the conduct of a pTA exercise. The second example illustrates the continuous adjustment and negotiation that is needed to articulate a position that "gives voice" and at the same time contributes to enacting the social. We believe it is important to account for these processes of trajectory making to enable a better understanding of the theoretical value of the position of social scientist, as well as the political relevance of his work.

3 Experimental normativity

In *Reconstruction in philosophy*, Dewey (1920: 28-53) develops his analogy between the natural sciences and the human sciences. He argues that the natural sciences have learned to go beyond the hierarchy that privileges contemplative knowledge over practical knowledge. Scientists, argues Dewey, do not passively observe nature to see if their ideas correspond to reality. Rather, they engage in an active experimental process by controlling conditions and manipulating the environment to test hypotheses and solve real-life problems. With this view as his starting point, Dewey argues that the human sciences can gain relevant knowledge of the social by testing ideas and intuitions and also revising them in the light of new experiences, thus enabling humans and their environments to continuously adjust to one another. He proposes an experimental ethics that refuses general perspectives based on theoretical certainties, instead advocating an ethics in "which the needs and conditions, the obstacles and resources, of situations are scrutinized in detail" (Dewey, 1920: 174). Dewey's position is close to James's, for whom "ethical science just, like physical science, and instead of being deducible all at once from abstract principles, must simply bide its time, and be ready to revise its conclusions from day to day" (James 1897: 208).

Research in ethics, then, is research about methodologies and generating "effective methods of inquiry" (Dewey 1920: 170). These methods produce knowledge about the world, as well as enable researchers to deal with situations that are potentially problematic for scholars and non-scholars alike. Dewey thus refuses the dualist perspective that separates a supposedly theoretical position from a politically relevant one, as it is through the intervention of the object under study that an "amelioration" of the current situation can be reached. In fact, plans for improvement have to be worked out; a point to which we turn shortly.

In further developing his experimental ethics, Dewey grounds research inquiry in experience, which for him encompasses both intellectual reflection and practical intervention. To convey this connectedness between reflection and action, he describes experience as "double-barreled" in that "it recognizes in its primary integrity no division between act and material, subject and object, but contains them both in an

unanalyzed totality" (Dewey 1958: 8). Accordingly, experimental ethics refuses rigid categorizations and a priori dichotomies (subject/object, insider/outsider, description/intervention) in so far that these arbitrarily reduce a set of multiple possibilities to one or two outcomes that are removed from actual human experience. For Dewey, philosophical intervention is thus best understood as an experimental process rather than as a mobilization of a set of ready-made instruments. While the conclusions it produces can be more or less stable, these are always "liable to modification in the course of future experience" (James 1897: vii).

In short, for pragmatists like Dewey and James, experience is a source for the constitution of knowledge and the construction of the social (Dewey 1958, Dewey 1988). It is embodied in a process that gradually stabilizes realities, allowing once again for human action to proceed. The analogy with natural science is useful. For one, Dewey and James insist on the practical character of intervention in the human sciences, including ethics. Second, pragmatism does not conceive of truth as a stable property, but sees it as a process through which a reality acquires validity (James 1978). Science studies, in turn, have demonstrated that scientific knowledge is based on successive trials (Latour 1988b). The notion of trial is also useful to account for the stabilization of the criteria that define what is morally good or bad (Boltanski and Thévenot 1991). Upon drawing together these lines of thought, experience emerges as a constituent part of the processes that stabilize technical and social realities. These processes, which comprise material and moral trials, can therefore be labeled experimental.

3.1 Reflection-in-action

Upon considering our own research in the light of classical pragmatism, both James and Dewey direct our attention to the processes we engage in as researchers of public participation. In insisting on the experimental character of these processes, and on the understanding that analysis and political intervention intertwine, they urge us not just to account for our research trajectories, but also to take seriously the challenge of defining the different forms under which intervention is possible. As our experiences with participation suggest, a variety of such forms are possible. For instance, the analyst may be too close to the actors he studies and may therefore want to restore a distance. Such action results from constant work and adjustments with the actors we study and cannot be described in terms of an epistemological distance between the subject and the object of his inquiry. Instead, one has to consider a plurality of modes of engagement across which the analyst circulates.

Accordingly, through experimentation the social scientist instigates relatively stable arrangements with the human and non-human actors he studies and works with, albeit in ways that lead to different answers for the researchers involved, as there is no unique way to "be normative." Rather than choosing from a list of existing modes of normative engagement, the research process leads the social scientist to articulate specific modes that are more or less stable, in the sense that they allow him to both account for his empirical exploration, and take into account his expectations vis-à-vis those of the actors he studies.

In this article the two empirical examples typified modes of normative engagement that help characterize the type of intervention we see fit for our own case. They were not given to us in advance. Nor will they remain fixed or stagnant, but develop according to the particulars of situation. Accounting for these evolutions is part of the research process, and implies that we include in our future descriptions explanations as to how relationships were established, roles assumed and alliances devel-

oped, as well as pinpoint the effects of our interventions on the actors and processes we engage with.

Experimental normativity then, is the work that is needed to articulate for ourselves modes of normative engagement based on continuous "reflection-in-action" (Schön 1987). We stress that reflection and action are interdependent to clarify a key difference between experimental normativity and "constitutive reflexivity" presented at the outset of this article. While the latter requires that the analyst detaches from himself and from his actions in order to identify what his underlying presuppositions and values are, we contend that values and relationships are constructed with the actors under modalities that are not given beforehand but need to be continually accounted for in the research process.[9]

3.2 Against relativism

Does our grounding of normativity in experimentation leave us with an extreme relativism that consents to any form of intervention? Dewey sees amelioration of the present situation as one of the aims of any work in ethics, yet he does not further develop the notion in *Reconstruction in philosophy*. For our purposes, we again invoke the concept of trial. Although it is conceivable that certain modes of normative engagement incite instability, we emphasize that neither the type of relationship, nor the distance between analyst and research subjects, is a pre, but has to be experimented with in practice. This means that the analyst's commitments and values (for instance, a desire to democratize technology) are not fixed, but constructed in a process that simultaneously produces knowledge and normative engagement. Seen in this way, the researcher's individual responsibility extends to the kinds of relations he manages with actors and to how he accounts in epistemological and normative terms for the particularities of his situation. Trials thus lead to question more than relationships with individuals: they are "problematic situations," as Dewey would say, in which public issues and social identities are interrogated at once, rather than separately.

A second reason to distinguish experimental normativity from relativism is that we conceive of knowledge accumulation as learning processes. Revising the conclusions from day to day, as is necessary with experimental normativity, does not mean that research happens in a state of permanent instability. The two trajectories we described are processes in which the analyst gradually learns about the object he studies and acquires a social understanding of his relationships with involved actors. Hence, learning occurs about the situation the analyst studies and the type of normativity he articulates. In addition, from the viewpoint of experimental normativity, learning again occurs through trials: of our relationships with the actors we study, of our positions with regards to our colleagues. Such knowledge accumulation supposes that it is both possible and necessary to experiment, that the researcher accepts to put himself at risk. The notion of trial also suggests that learning is not necessarily a collaborative or harmonious enterprise, as the relationships between actors are not given from the start and often evoke resistance to social scientific intervention (Callon and Rabeharisoa 2004, Vikkelsø 2007). In fact, learning may well agonize relations between actors (temporarily or even more permanently), for instance when the analyst distances himself from a certain kind of participation (trajectory 1) or refutes commitments that other actors

[9] To further clarify this difference: the reflexivity answer would imply that the analyst isolates punctual decisions and weighs the pros and cons of a given form of engagement, while experimental normativity seeks to account for the continuous production of particular forms of arrangements.

confer upon him (trajectory 2). Hence, experimental normativity is not about making purely subjective choices, but about ensuring the stability of a particular arrangement between the analyst and the actors he studies. As the two examples show, stability is not a permanent feature. As he faces new demands from the actors he studies, or attempts to articulate an explicitly critical stance, the social scientist may be led to enact other modes of normative engagement. "Stability" thus denotes an arrangement that is sufficiently reliable to inform our future actions. Having terminated a sequence of inquiry, we depend on "evidence already marshaled and constructive work already done" to experiment anew (Hickman 2009: 147).

3.3 The political value of experimental normativity

It should be clear from the emphasis we place on ongoing reflection-in-action, flexibility, and the open-endedness of social scientific engagement that experimental normativity conveys the significance and usefulness of ambivalence in experimentation; that is, of situations where the social scientist has the possibility to navigate across different modes of normative engagement. In the two cases described in this article, the researcher is caught up in existing expectations and forms of action, as we are both invited to engage as insiders on terms set by participation initiators, or assume a more descriptive role as outsiders. While the extent to which it is possible for us to work around these expectations (or even decline them) differs, our experimentations with normativity each suggest ways of moving beyond this implied insider/outsider dichotomy and of thinking through individual and collective identities.

Consequently, although we recognize the plurality of modes and their potentially conflicting nature (as well as potential overlaps between them), we first and foremost stress the need to explore with actors the types of engagement that demand articulation in a given situation without prescribing which mode is more appropriate. Experimental normativity should be distinguished from a meta-mode that provides tools and rules for the management of the analyst's normative engagement. It is best understood as an *attitude* that seeks to multiply experiments, thereby displaying the normative modes at play and proposing new forms of arrangements with the actors in question. While experimental normativity does not provide a rationale to guide the social scientist in every circumstance, it does insist on the connections that he can draw between different empirical sites. Upon drawing these connections the social scientist can shape alternative forms of political action.

What should be avoided is the a priori establishment of a distance between the analyst and the actors he studies. Rather, the social scientist must attend to the multiplicity of distances and critiques that arise from the particularities of a problematic situation. As such, critique, whether distanced or of a more intimate kind, exemplifies a "mode of responding" to the concrete activities and challenges that emerge in research practice (Zuiderent-Jerak and Jensen 2007). It also recognizes the deeply political dimension of the engagement process: through negotiations a relatively stable mode of normative engagement may emerge, which encapsulates the various roles and identities that both the analyst and the actors he studies assume in a particular situation. It is therefore crucial that the experimentalist in normativity is able to connect different sites and, through his scholarly production, shed light on multiple modalities, for instance in the realm of public discussions of science. And although these acts of connecting and describing may in some cases hold claims that are similar to the rationales that underpin

public participation in the first place (e.g. through the notions of collective experimentation and social learning encountered in pTA), the value of his social scientific work and significance of his political intervention lies in his capacity to account for this multiplicity, as well as to decisively move across various modes of normative engagement as he meets challenges on the way.

4 Conclusion

This article describes various forms of normative engagement the social scientist enacts in public participation in science and technology. It discerns a process mode, a critical mode, and an Actor Network Theory inspired form of engagement, which we extract from our experiences as social scientists with public participation in nanotechnologies. With the aim of accounting for our normative commitments in research practice, we propose an experimental approach that negotiates between the various normativity repertoires starting from the particularities of our situations. Hence, we seek to come to grips with the issue of how the social scientist is to interact with the actors he studies, given the normative questions that arise through his engagements. Taking inspiration from classical pragmatists, we argue that these questions cannot be answered in the abstract, but require that the social researcher empirically explores his potential roles and contributions in a given setting and continuously accounts for his experiments.

We ground our normative reflections in our experiences with participatory initiatives in nanotechnologies. The multiplicity and variety of participatory initiatives in "nano," and the uncertainties related to the construction of "nano" publics and objects, enable, and compel, us to describe different forms of scholarly involvement. While we do not claim to have mapped out all the forms of social research involvement, we do believe our analysis elucidates a variety of participation postures and suggests their potential. If the social scientist intends to experiment with mediation for instance, as from an ANT perspective, empirical explorations of the diverse translation processes through which he enacts the social will be of much interest to him. They will also be necessary to account for the scholarly and political relevance of his work. Researchers in participatory technology assessment may in turn consider "mediation" as a means of reflexively attending to the roles they assume, and do not assume, in participatory spaces.

For scholars of reflexivity more generally, our experiences open a "window on the world" (Rip 2003: 361) as they enable a wider debate on the values and interests that inform social inquiry. In the context of public participation in science and technology, where the roles of academic scholars vis-à-vis non-academic researchers and practitioners are not clearly demarcated, our reflections may be of use in that they help specify the character of scholarly contributions to the field. This specificity consists in accounting for actions (e.g. shifting and deepening engagements) and situations in epistemological and normative terms without therefore dismissing the political alignments of the actors we study. While in the cases described above some professionals disproved of how we each problematized participation in our respective contexts, we contend that the modes we outline in this article, and how one negotiates between them, can serve action-oriented actors as resources. For one, public engagement inevitably implies a blurring of different roles in practice (as we have seen), which renders the conventional distinction between practitioner and analyst simply untenable (see also: Chilvers 2012). Second, given the political-economic significance of nanotechnology research, there is a real risk that *all* social sciences are

trivialized or instrumentalized through, or despite, participatory processes. Practitioners, as well as analysts, must therefore consider what is at stake for them. Drawing out normative differences between actors, programs, and instruments can contribute to this aim of mutually informed positioning and articulation. At the very least, such articulation would render participatory social science more socially accountable and politically resilient, analogous to how social scientific interventions in technology can render "scientific cultures more self-aware of their own taken-for-granted expectations, visions, and imaginations" (Macnaghten et al. 2005). More importantly, it can enable social researchers to reflectively readjust and reposition themselves in the face of real-world challenges and concerns. Even if readjustments of this kind may not appear feasible, for instance because the social scientist is obliged to play a *particular* role, it would be naïve to assume that his disposition will go uncontested in practice. As Abels (2009) contends in answer to the question What role for social scientists in participation?, social scientists can, and already *do*, experiment with different commitments and orientations because they must. It would therefore be a mistake to leave the practical and political implications of their commitments unexamined and unaccounted for.

That being said, and having touched upon the weighty issues of normativity and politics in research, it is important to be modest about what our analyses and reflections may achieve, particularly as the situations we describe are still in the making. Secondly, as experimental normativity underscores the multiplicity of modes of knowledge production and engagements, experimentation need not, and should not, be limited to the individual researcher or to our cases. One can hope that for one scholar who organizes public discussions, there will be another one providing a critique of them. For one social scientist calling for institutional reflexivity (Wynne 1993), another one will propose empirically based examinations of social scientists who engage with natural scientists on the lab floor (e.g. Fisher 2007). Thus, as we describe the interventions of social scientists in participatory activities in nanotechnology, we welcome others to examine, engage with, and question our involvement practices and the experimentation with modes that we find compelling and seek to articulate.

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6 References

Abels, Gabriele, 2009: Organizer, observer and participant. What role for social scientists in different pTA models? In: Priska Gisler/Silke Schicktanz (eds.), *Science, Technology & Innovation Studies* 5(1), Special Issue on the role of social sciences in science policy making, 19-36.

Barben, Daniel et al., 2008: Anticipatory governance of nanotechnology: Foresight, Engagement and Integration. In: Edward J. Hackett/Olga Amsterdamska/Michael Lynch/Judy Wajcman (eds.), *The Handbook of Science and Technology Studies: Third Edition*. Cambridge: The MIT Press, 979-1000.

Bennett, Ira/Daniel Sarewitz, 2006: Too Little, Too Late? Research Policies on the Social Implications of Nanotechnology in the United States. In: *Science as Culture* 15(4), 309-325.

Boltanski, Luc/Thévenot, Laurent, 1991: *De la justification. Les économies de la grandeur.* Paris: Gallimard.

Bourdieu, Pierre, 1980: *Le Sens Pratique.* Paris: Minuit.

Burchell, Kevin, 2009: A helping hand or a servant discipline? - Interpreting non-academic perspectives on the roles of social science in participatory policy-making. In: Priska Gisler/Silke Schicktanz (eds.), *Science, Technology & Inno-*

vation Studies 5(1), Special Issue on the role of social sciences in science policy making, 49-61.

Callon, Michel, 1999: Ni intellectuel engagé ni intellectuel dégagé. La double stratégie de l'engagement et du détachement. In: *Sociologie du travail* 41(1), 65-78.

Chilvers, Jason, 2012: Reflexive Engagement? Actors, Learning, and Reflexivity in Public Dialogue on Science and Technology. In: *Science Communication* XX(X), 1-28.

James Clifford/George Marcus (eds.), 1986: *Writing cultures. The poetics and politics of ethnography.* Berkeley: University of California Press.

CEC, 2005: *Nanosciences and nanotechnologies: An action plan for Europe 2005-2009.* Brussels: Commission of the European Communities (CEC).

Dab, William, et al., 2009: Risques et bénéfices des nanotechnologies: le besoin de nouvelles formes de débat social. Premier bilan du Nanoforum du Cnam. In: *Annales de Mines* 55, 55-61.

Dewey, John, 1920: *Reconstruction in Philosophy.* New York: Henry Holt.

Dewey, John, 1958: *Experience and Nature.* New York: Mineola.

Dewey, John, 1988: *The Public and its problems.* Athens: Swallow.

Doubleday, Robert, 2007: Risk, public engagement and reflexivity: Alternative framings of the public dimensions of nanotechnology. In: *Health, Risk & Society* 9(2), 211-227.

Fisher, Erik, 2007: Ethnographic Invention: Probing the Capacity of Laboratory Decisions. In: *NanoEthics* 1(2), 155-165.

Fuller, Steve, 2000: Why Science Studies Has Never Been Critical of Science: Some Recent Lessons on How to Be a Helpful Nuisance and a Harmless Radical. In: *Philosophy of the Social Sciences* 30(1), 5-32.

Gomart, Emille/Antoine Hennion, 1999: A sociology of attachment: music amateurs, drug users. In: John Law/John Hassard (eds.), *Actor-Network Theory and After.* Oxford: Blackwell, 220-247.

Goorden, Lieve et al., 2008a: Nanotechnologies for Tomorrow's Society: A Case for Reflective Action Research in Flanders, Belgium. In: Erik Fisher/Cynthia Selin/James Wetmore (eds.), *The Yearbook of Nanotechnology in Society. Volume 1: Presenting Futures.* Dordrecht: Springer, 163-182.

Goorden, Lieve, 2008b: Lose one another… and find one another in nanospace. Nanotechnologies for Tomorrow's Society: a case for reflective action research in Flanders (NanoSoc). In: *NanoEthics,* 2(3), 213-230.

Gorelick, Sherry, 1991: Contradictions of Feminist Methodology. In: *Gender and Society* 5(4), 459-477.

Hamlett, Patrick, 2003: Technology theory and deliberative democracy. In: *Science, Technology, & Human Values* 28(1), 112-140.

Heron, John, 1996: *Co-operative Inquiry: Research into the Human Condition.* London: Sage.

Hickman, Larry, 2009: Pragmatism, Constructivism, and the Philosophy of Technology. In: Larry Hickman/Stefan Neubert/Kersten Reich (eds.), *John Dewey Between Pragmatism and Constructivism.* New York, Fordham University Press, 143-161.

James, William, 1897: *The Will to Believe, and Other Essays in Popular Philosophy.* New York/London/Bombay: Longmans Green and Co.

James, William, 1976: *Essays in radical empiricism.* Cambridge: Harvard University Press.

James, William, 1978: *Pragmatism and the meaning of truth.* Cambridge: Harvard University Press.

Jasanoff, Sheila, 1996: Beyond Epistemology. Relativism and engagement in the politics of science. In: *Social Studies of Science* 26(2), 393-418.

Joly, Pierre-Benoît/Alain Kaufman, 2008: Lost in translation. The need for upstream engagement with nanotechnology on trial. In: *Science as Culture* 17(3), 225-247.

Latour, Bruno, 1988a: The politics of Explanation: An Alternative. In: Steve Woolgar (ed.), *Knowledge and Reflexivity. New Frontiers in the Sociology of Knowledge*. Thousand Oakes: Sage, 155-176.

Latour, Bruno, 1988b: *The Pasteurization of France.* Cambridge: Harvard University Press.

Latour, Bruno, 2005: *Reassembling the social. An introduction to Actor-Network Theory.* Oxford: Oxford University Press.

Laurent, Brice, 2007: Diverging convergences. In: *Innovation: the European Journal of Social Sciences*, 20(4), 343-358.

Laurent, Brice, 2010: Participation du public et nanoparticules. Traiter les risquesdes nanoparticules d'argent en démocratie. In: Stéphanie Lacour (ed.), *Clair-Obscur normatif. La Régulation des Nanotechnologies.* Brussels: Larcier, 153-174.

Law, John, 2004: *After Method. Mess in Social Science Research.* London: Routledge.

Law, John/John Urry, 2004: Enacting the social. In: *Economy and Society* 33(3), 390-410.

Loeber, Anne, 2004: *Method and Practice of Interactive Technology Assessment*. Learning from a Dutch analytic experiment on sustainable crop protection. Paper presented at the Joint 4S/EASST Conference, Paris, August 25-28.

Macnaghten, Phil et al. 2005: Nanotechnology, governance and public deliberation: what role for the social sciences. In: *Science Communication*, 27(2), 268-291.

McCarthy, Joan, 2003: Principlism or narrative ethics: must we choose between them? In: *Medical Humanities* 29, 65-71.

Nahuis, Roel/Harro van Lente, 2008: Where are The Politics? Perspectives on Democracy and Technology. In: *Science, Technology, & Human Values* 33(5), 559-581.

Radder, Hans, 1998: The Politics of STS. In: *Social Studies of Science* 28(2), 325-331.

Reason, Peter/Hilary Bradbury (eds.), 2001: *Handbook of Action Research.* London: Sage.

Rip, Arie, 1986: Controversies as Informal Technology Assessment. In: *Knowledge: Creation, Diffusion, Utilization* 8(2), 349-371.

Rip, Arie, 2000: *Following Actors – Then What?* Invited paper, Seminar Neuere Ansätze und Methoden in der Wissenschafts- und Technikforschung, Technische Universität Darmstadt, May 5.

Rip, Arie, 2003: Modernity and Technology – An Afterword. In: Thomas J. Misa/Philip Brey/Andrew Feenberg (eds.), *Modernity and Technology.* Cambridge: The MIT Press, 359-372.

Robinson, Douglas, 2010: *Constructive Technology Assessment of Emerging Nanotechnologies. Experiments in Interaction*. Dissertation. Enschede: University of Twente.

Schön, Donald, 1987: *Educating the Reflective Practitioner*. San Francisco: Jossey-Bass.

Schot, Johan, 2001: Towards New Forms of Participatory Technology Development, *Technology Analysis & Strategic Management* 13(1), 39-52.

Sclove, Richard, 1995: *Democracy and technology.* New York: The Guilford Press.

Stirling, Andrew, 2008: "Opening Up" and "Closing Down." Power, Participation, and Pluralism in the Social Appraisal of Technology. In: *Science, Technology, & Human Values* 33(2), 262-294.

Taves, Ann, 2003: Detachment and Engagement in the Study of 'Lived Experience.' In: *Spiritus* 3, 186-208.

Van Oudheusden, Michiel, 2007: Nanonu, maar hoe? In: *EOS-magazine,* (11), 113.

Van Oudheusden, Michiel, 2011: Questioning 'Participation': A Critical Appraisal of its Conceptualization in a Flemish participatory Technology Assessment. In: *Science and Engineering Ethics,* 17(4), 673-690.

Van Oudheusden, Michiel et al. (2007): '*Nano-imaginaries'* in a Future Smart Environment. Breakdown of a Three-Round Delphi Study. Report written for the Flemish Institute for the Advancement of Innovation through Science and Technology (IWT).

Vikkelsø, Signe, 2007: Description as Intervention: Engagement and Resistance in Actor-Network Analyses. In: *Science as Culture* 16(3), 297-309.

Wilhelmson, Lena, 2002: On the Theory of Transformative Learning. In: Agnieszka Bron/Michael Schemmann (eds.), *Social Science Theories in Adult Education Research*. Münster: LIT Verlag, 180-210.

Woodhouse, Edward et al., 2002: Science Studies and Activism. Possibilities and Problems for Reconstructivist Agendas. In: *Social Studies of Science* 32(2), 297-319.

Woolgar, Steve, 1988: Reflexivity is the ethnographer of the text. In: Steve Woolgar (ed.), *Knowledge and Reflexivity.* London: Sage, 14-34.

Wynne, Brian, 1993: Public uptake of science: A case for institutional reflexivity. In: *Public Understanding of Science* 2(4), 321-337.

Wynne, Brian, 1996: SSK's Identity Parade: Signing-Up, Off-and-On. In: *Social Studies of Science* 26(2), 357-391.

Wynne, Brian, 2007: Public Participation in Science and Technology: Performing and Obscuring a Political-Conceptual Category Mistake. In: *East Asian Science, Technology and Society: An International Journal* 1(1), 99-110.

Zuiderent-Jerak, Teun/Casper Bruun Jensen, 2007: Editorial Introduction: Unpacking 'Intervention' in Science and Technology Studies. In: *Science as Culture* 16(3), 227-235.