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A Socioenvironmental Shale Gas Controversy: Scientists' Public Communications, Social Responsibility and Collective Versus Individual Positions

Gregoire Molinatti^{1,2} and Lionel Simonneau^{1,3}

Abstract

In this case study, we analyze the discourse, practices and representations of a group of scientists who issued public statements about the French shale gas controversy. The reasons they gave for engaging in this process of communication focused on their social responsibility, their collective *ad hoc* expertise and the neutrality of their position. We also investigated how these scientists actually produced their communications, despite the tensions between individual and collective positions. We discuss how this experience led them to reflect both individually and collectively on their representations of science in society.

Keywords

scientists, communication, expertise, social responsibility, neutrality, reflexivity, socioscientific issues, shale gas

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As academic research scientists, it is our role to communicate and broadcast scientific information all around us. In terms of scientific publication, it isn't worth it—but it's noble to do so. (Researcher E)

Scientists' attitudes to participating in efforts to explain their activities to the public and their motives for doing so have been widely investigated. Several findings have emerged from these studies: first, the great majority of the scientists questioned on this topic referred to the scientific illiteracy of the public, in accord with the knowledge deficit model (Besley & Nisbet, 2011; Sturgis & Allum, 2004), which reflects the existence of one-way, top-down communication processes from scientists to the public (Casini & Neresini, 2012; Davies, 2008); second, scientists' belief that science should further the public good (Besley, Oh, & Nisbet, 2012) has often incited them to improve the awareness and enthusiasm of the public for science by committing themselves publicly to a scientific cause (Martin-Sempere, Garzón-García, & Rey-Rocha, 2008; Pearson, Prinkle, & Thomas, 1997; Poliakoff & Webb, 2007); and third, some criticisms have been made about the mass media (Besley & Tanner, 2011; Peters, Heinrichs, Jung, Kalfass, & Peterson, 2008), although most scientists have agreed that use should be made of these channels (Peters, 2013).

However, when the public turns out to be no longer a knowledge vacuum but rather an active, opinionated audience, especially as far as socioscientific controversies are concerned, interactive modes of scientific communication can emerge (Besley, Kramer, & Priest, 2008; Davies, 2008).

In this study, we focus on an original case of scientific communication, where a group of geological scientists decided to pool their expertise in connection with the current shale gas controversy and to communicate this expertise directly to the lay members of the local population.

Scientific Mediation in the Context of New Relationships Between Scientists and Society

The shale gas debate on which this study focuses can be said to be socioscientific controversy, which Latour (1988, 2004) has defined as a mutual construction between science and society. In the present system of technical democracy characterized by "hybrid forums" (Callon, Lascoumes, & Barthe, 2009), debates of this kind involve both laypeople's knowledge and scientific knowledge.

In line with Pestre (2003), we propose here to approach science in society in the context of new policies and the new moral knowledge economy characterized by short-term financial logics. During the last 20 years, various

procedures have been used in many countries to incite the citizens to participate in technoscientific decision making.¹ This move to promote citizens' active participation can be said to constitute a considerable break from the previous technocratic model for the relationships between science and decision making, in favor of a more pragmatic Habermasian model. At the same time, in the field of scientific and technical communication, linear top-down models for the transmission of scientific knowledge, which Irwin and Wynne (1996) have called "deficit-model", have been increasingly criticized. In this context, what do scientists think about communicating their knowledge?

Scientists have in fact been claiming that they do not want to stay on the sidelines of this movement but prefer going out to meet the public.² The development of meetings and debates between research workers and non-specialists therefore constitutes one of the strongest contemporary trends in scientific mediation. The means of scientific mediation that originally accompanied the emergence of modern science before they were supplanted by professional mediators are therefore now undergoing a revival (Schiele, 2005).

Most of the studies published so far on the communication practices of research workers and their ideas about scientific communication have been quantitative studies (Kunth, 1992; Mori, 2000; Royal Society, 2006). Otherwise, in his study on the *scientist's social responsibility*, Boy (2007) documented scientists' ethical awareness of the potential consequences of their discoveries. Scientists were described in this study as citizens like any others, duly taking social opposition to technical innovations into account; recognizing citizens' right to have a say in scientific and technical decisions by participating in associations, ethical commissions, public debates, and actions on the field; and even making political decisions by taking part in elections.

Few qualitative studies have focused, however, on how scientists communicate their expertise on controversial issues to the public (Davies, 2008; Horst, 2013). The controversy surrounding genetically modified organisms that arose in France has shown, for example, how difficult it can be for scientific communities to convey information to the lay members of the community about the risks potentially involved in developments of this kind (de Cheveigné, 2002). These studies have generally consisted in analyzing research workers' discourse, often in terms of their representations of the connections between science and society, focusing, for example, on the values assigned to knowledge by the scientists questioned (Molinatti, 2011).

The most original feature of the present case study is the qualitative approach used to analyze scientists' discourse and representations as well as their communication practices. Another novel aspect is the fact that we

studied the communication processes not only at the individual level but also at the level of these scientists as a group.

A Communication Framework Questioning Scientists' Public Expertise

In this field of research, it is generally assumed that research scientists and nonspecialists occupy symmetrical positions. Since the representations of members of the public, who occupy nonscientific spheres, have been previously investigated in detail, it was proposed here to study the representations of the members of scientific spheres with a view to drawing up a more balanced overall picture. Especially in the case of socioscientific issues, such as that involved here, there is no justification for sustaining a great divide between scientists and laypeople. Besides, in the hyperspecialized world of scientific research, the complexity of the questions arising about science and society has brought to light the existence of a huge amount of *nonexpertise* among scientists, whose individual fields of expertise are obviously quite narrow (Levy-Leblond, 2001, 2004). Since scientists are also active citizens in an evolving technoscientific society, it therefore seemed to be worth investigating researchers' own representations of science in society.

The present research comes under the heading of the pragmatic sociology of conflicts because socioscientific controversies contribute to reorganizing the balance of power and the links of legitimacy that exist between individuals in a given social context. In line with Chateaufrenaud (2007), we regard sociotechnical controversies as play-acting and a set of arguments associated with a particular context. From this point of view, research scientists talking about a controversy become full-fledged social players in this controversy.

The theoretical background of our research is that of studies on communication in the field of science, techniques and society (STS). In line with Verón's (2013) theory of social semiosis, we have adopted a nonlinear model for communication focusing on the processes involved in the social circulation of discourse about science, with special emphasis on the conditions of production of this discourse. We approach scientific communication here not only in semiotic terms (i.e., focusing on the meaning of the discourse) but also as social facts, defined as reconfigurations of the social statuses of the communicators.

The present plural anthropological study (de Cheveigné, 2002) therefore focused on the practices involved in the production of communicational discourse as well as on the producers' representations. We will therefore

examine the interactions involved in producing these communications, in the light of scientists' social representations, since these representations determined their exchanges with each other as well as with nonspecialists and the members of the research team conducting the interviews (Moscovici, 1984). These representations are dynamic entities because they are liable to be updated in a given communication situation.

In line with this rationale, we first examined the reasons given by these scientists for deciding to communicate in public about the exploration and extraction of shale gas (EESG) reserves using hydraulic fracking methods, in the context of the social controversy that had arisen on this topic. What kind of arguments and what axiological criteria in general were mobilized for this purpose by the scientists in question?

Our second question focuses on how these scientists actually produced their communications (i.e., on the process of co-construction of their communicational discourse, whereas there was no consensus among them about the facts). First we looked at how the members of the group managed to integrate their individual points of view, and then we looked at how the scientists involved in the collective process of mediation managed to maintain their own individual stances.

These questions were based on the following two hypotheses: first, that analyzing communication processes constitutes a relevant means of understanding scientists' opinions about science and its relationships with society as well as their own social roles. Second, according to what has been called *reflexivity by communicating* (Jurdant, 1993), it emerged that communicating with nonspecialists induces scientists to take a more reflexive look at the epistemological foundations and the social implications of their own research work.

The Context of the “Explosive” Dynamics of a Socioenvironmental Controversy Arising at the Regional Level

On July 13, 2011, the French Parliament passed a law repealing the permission previously granted throughout the national territory to explore for shale gas and to work the reserves using hydraulic fracking methods, which had triggered intense social opposition, starting in the South of France at the end of 2010.³ In response to the news widely broadcasted that the French government was issuing exclusive permits to search for liquid or gas hydrocarbon deposits, increasing public opposition was voiced during the first few months of 2011 (see Figure 1).⁴

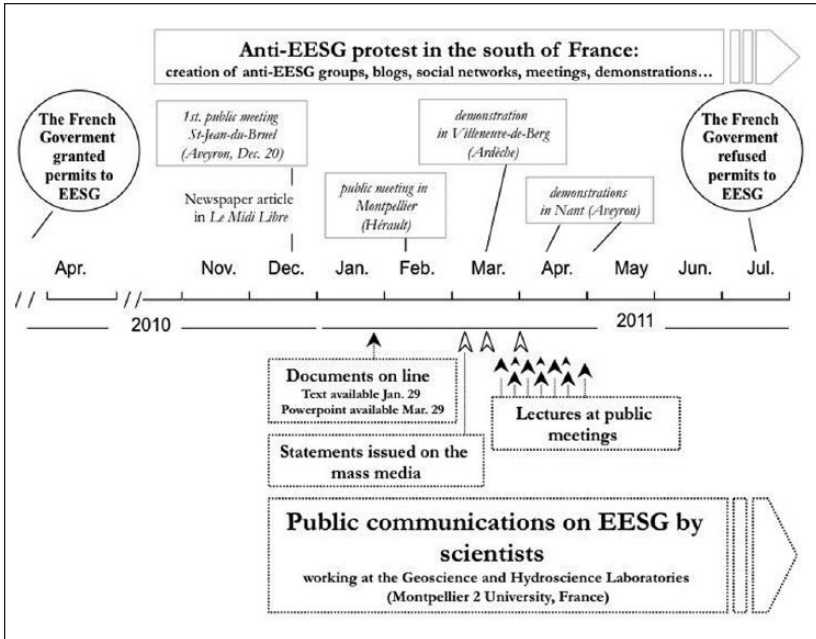


Figure 1. The various forms of communication used by the geologists and hydrogeologists to inform laypersons during the French controversy about the exploration and excavation of shale gas (EESG); the evolution of events with time. The main events in the anti-EESG social protest are shown above the timeline (examples are presented in italics). The citizens' mobilization is still being expressed after July 2011 in blogs and social networks (as symbolized by the arrowhead displayed at the upper right side). The round frames contain governmental decisions. The events that occurred during the period of time when the scientists were informing the public intensively about the EESG are marked below the timeline. About 15 lectures were given at public meetings attended by an audience ranging between 20 and 200 people. Some scientists were still giving lectures later on (as symbolized by the large arrowhead displayed at the bottom right side). Efforts at communication also took the form of participation in official commissions: for a parliamentary enquiry (March 15, 2011, Paris) and in a governmental commission (Police Headquarters, June 16, 2011, Montpellier; data not shown).

At the forefront of this social controversy, some geological research scientists working at Montpellier 2 University of Science and Technology (UM2) decided to communicate their knowledge and uncertainties to the lay population from January to March 2011.⁵ They therefore organized internal meetings at the laboratory and produced a document and a slide show assessing

the situation. They also took part in public information meetings, interviews with the media, and official commissions (Figure 1). The document assessing the controversy was posted online on the UM2 website on January 29, 2011, and presented to the press.⁶ The slide show was the official means of communication used at the public meetings up to the end of April, when the scientists decided to stop publishing this information collectively.

Terrains and Methods

This study consisted of three methodological steps.⁷ First of all, we conducted an argumentative analysis of the discourse produced collectively by an appointed group of research workers and presented by their spokesmen to the public (Goffman, 1974). The epistemic, axiological, and ontological aspects of the controversy mentioned by the members of the group interviewed were identified by examining how the controversy was framed. According to the definition proposed by Nisbet and Mooney (2007), frames “organize central ideas, defining controversy to resonate with core values and assumptions,” and they “pare down complex issues by giving some aspects greater emphasis” (p. 56).

In the second stage, we personally conducted in-depth semistructured interviews with 13 scientists. Ten of them described themselves as the most active participants in the process of production of expert knowledge on EESG and the documents presenting this knowledge to the public, one was a member of the administrative staff, and two others were members of the laboratory who were not directly involved in producing the public statements. These scientists belonged to 10 different groups working on various topics in the fields of geology and hydrology, and most of them were the group leaders. We asked them what they felt personally about the process of production of collective statements (including the chronology of the main events involved in the controversy and that of the scientists’ presentations, and the regulatory processes at work in the public communication group) and their own role in this process (the group meetings they had attended, their e-mail and face-to-face exchanges with the other members of the group, their involvement in public meetings and interviews with representatives of the media, etc.). The aim of these interviews was to compare the respondents’ discourse with their practices and their representations about their communications. These scientists were also asked individually what they thought about the controversy (including their own arguments and axiological criteria) and how their personal opinions fitted in with their position as members of the group as well as what they thought about the relationships between science and society (in terms of expertise, conflicting interests, media

coverage, etc.). These interviews were recorded, transcribed and coded inductively by the authors.⁸

Four months later, we carried out interviews on two focus groups (one focus group consisting of four scientists and the other one of three scientists who agreed or volunteered to participate). The aim of these focus groups was to document the points of agreement/disagreement that had been noted during the individual interviews in connection with their experience of the controversy. During both the individual interviews and the focus groups, the researchers were asked about the group's practical rules; how they regarded the public, the media, and mediation; and whether they had evolved as regards the question of neutrality.⁹ Special attention was paid to discussions among scientists, which were encouraged during the focus groups and sometimes reflected the existence of strong disagreements.

As far as the scientists' communication practices were concerned, we documented the meetings they attended together and with the public (including the content of the agendas, the numbers in attendance, and the settings of these meetings), the e-mail exchanges between the scientists, and the methods used to manage the group. Based on Latour and Woolgar's (1979) sociological approach to understanding the construction of scientific facts, we attempted here to analyze exactly how these scientists produced their public statements.

Results

The Scientists' Reasons for Communicating Their EESG Expertise Publicly

At the turn of the year 2011, a socioenvironmental controversy described as "explosive" resulted in the emergence of two opposite factions at the laboratory. Some of its members claimed that citizens had the right to take an interest in a topic to which "it was impossible to remain insensitive," whereas others took a more dispassionate view of the controversy and had "trouble defining it," voicing the opinion that politics should not be allowed to interfere with a purely environmental problem. It was decided in the end to present the situation to the public without enlisting any professional mediators. This was therefore a perfectly independent initiative, since it was not launched in response to the demands of public institutions, industrial companies, or political groups.¹⁰ Some of the scientists said that this autonomy was a prerequisite for this communication project to be valid:

But if there had been constant pressure from my institution via either the VCPA [the vice president of the university's board of administration] or the director [of the Institute], I would have stayed out of it. (FG, J, 50')

The scientists questioned gave three main reasons for their spontaneous involvement in the public debate.

Social Responsibility in Response to Perceived Social Demands. In the context where the social controversy had pervaded the life of the laboratory, as we will show below, its members used their social responsibility to explain why they had decided to respond to the perceived public demand for expertise, especially as some EESG permits had already been granted in this part of France. Some of the scientists stated quite simply that citizens have the right to be informed about controversial subjects, such as EESG. They felt it was up to them to provide this information:

Something is going on and we, as members of a scientific laboratory, have something to say to . . . to help people understand it. (iG, 4')

The director of the laboratory stepped in by suggesting that they should pool their expertise and communicate it together:

The director must have thought, "OK, therefore (1) the lab is going to have to communicate with the public because they're going to ask us questions. (2) We'd better communicate the scientific viewpoint as a group. We could all present our individual positions, but the lab as a whole would be able to present these ideas in a more orderly way." So we decided to form a work group. (iH, 7')

For 4 to 6 weeks, these scientists were caught up in a movement that was unanimously described as a "lively dynamic process," inspired by the idea that the citizens and administrative organizations were looking for expert speakers whom they could trust. During January 2011, a few research workers and the head of the laboratory stressed the need for a special internal seminar to be attended by all the members of the Geoscience Laboratory prior to the production of the forthcoming public statements.

Collective Competence in Setting Up Ad Hoc Expertise Under the Banner of Scientificity. These research workers said that their reasons for communicating their knowledge to the public were based on the collective epistemic competence that resulted from pooling their individual expertise. Some of them

joined the communication committee because they were experts in one of the aspects of the question under debate:

I was added to the circle . . . because they reckoned that I'm a specialist in fracking and also because I was working on the problem of reservoirs. (iE, 05')

So they asked me to join in. Because I'm a specialist in water pollution. (iI, 11')

However, these specialists became aware that their degree of scientific competence did not suffice to meet the citizens' expectations:

We feel we don't really have enough knowledge ourselves about what exactly is emerging. (iK, 05')

None of the scientists taking part in this assessment claimed to master all the many aspects of this controversy. Some of them even said that at the beginning, they were far removed from the theme of nonconventional hydrocarbons and their extraction, of which they were hardly even aware. When speaking about the final summarizing report produced, researcher K said,

A certain number of things in this report were clearly beyond our knowledge initially . . . but have come into our group assessment because we're working on them. (iK, 4')

They therefore made it a priority to forge a body of EESG expert knowledge together. Working as a group for about "a month or so," they enlightened themselves and each another and exchanged notes about the scientific literature and "factual things" (permits, the nature and location of boreholes, etc.). The implicit fundamental common goal was to remain within the scope of their own professional practices, namely, to uphold "scientificity":

Yes, this is part of our unwritten charter. . . . We are scientists and we want to remain scientists. (iG, 14')

We thought we could start discussing serious matters and divulging them outside the lab by simply basing what we say on . . . I mean . . . on scientific publications, naturally of a high standard. (iE, 3')

These scientists felt they were perfectly capable of compiling together a fairly exhaustive review of the literature on hydrocarbon reserves, fracking, the properties and dynamics of the aquifer, and the sensitivity of the environment to pollutants. Since they often had to change their research themes

during their careers, they felt they had developed “the ability to understand a problem, read up previous studies by other authors, summarize them, and grasp their gist” (iK, 43’). The members of the group stressed their ability to write critical reviews (including not only research articles but also appraisals and technical reports produced by private companies) in applied geotechnical fields that were sometimes far removed from the more fundamental topics in which they were specialized.

To Produce Neutral Statements as a Prerequisite for Credibility. In the public statements produced by the group, the scientists did not give their opinion as to what should or should not be done as regards going ahead and exploring for potential shale gas deposits. They claimed to have adopted a more neutral stance in that they did not support one particular political position rather than another. This meant

giving a picture which is not politically committed, attempting to present the facts known at present about the good and bad aspects of extracting SG [shale gas] at present. (Director of the Institute, in a France 3 TV broadcast on March 4, 2011).

The scientists involved claimed, “We say what we know, we answer the questions but we don’t judge, we don’t give our opinion”; there was no question of expressing personal opinions about the controversy for fear of “losing the credibility of our information” (iG, 19’).

In this spirit, the Geoscience and Hydrosience Laboratories signed the summary document. The five chapters covering eight pages of text explained the “current situation,” which is “likely to evolve as our knowledge progresses, especially as regards the risks involved and the nature of the exploration carried out” (Géosciences Montpellier, Hydrosiences Montpellier & Observatoire de Recherche Méditerranéen de l’Université de Montpellier 2, 2011, p.2). Two research geologists and two research hydrologists signed the slide show, which was the official means of communication used at the public meetings. Like the slide show, the final report contained arguments on both sides.¹¹ The way the controversy was framed by the researchers took into account the economic context and the geological conditions involved in working these resources as well as the environmental risks liable to arise. It therefore contained arguments (such as the increasing demand for new energy supplies) in favor of working deposits that had not been tapped so far “because of the production costs” as well as arguments on the other side, focusing on the “high environmental risks” involved. The content of the statements issued was therefore fairly well balanced with pro and cons arguments.

Having examined why these scientists were engaged in this process of communication, we then looked at how they actually produced their collective presentations.

The Production of Public Statements Under Tension Between Individual and Collective Positions

We therefore examined how the group of spokespersons was set up at the laboratory and how it was proposed to ensure neutrality between the individuals and the group as a whole.

Collective Management of the Individual Positions

When this social controversy took hold of the laboratory, it revived and updated previous axiological conflicts. Echoing the lively process of questioning and opposition to EESG that was taking place outside the laboratory, a strong controversy developed within its midst. This was not simply an epistemic disagreement, such as those that often occur between peers, mobilizing theoretical and experimental arguments on the scientific front. It was actually a conflict that had been stirred up among these colleagues “early on” without ever being properly debated:

It had been going on for a long time at the laboratory. This was an internal controversy within the lab. (iE, 24')

This conflict had resulted from differences between the scientists' ideas about their activities and the contribution of their work to society. These unvoiced differences of opinion took a particular turn, since they focused not only on the usefulness and consequences of EESG but also more generally on the scientific and “philosophical” links between scientific activities, the industrial world, and the social sphere. It is precisely because of these axiological and epistemic questions that the controversy arising at this laboratory was so unusual.

We were not able to specify exactly which members of the Geoscience Laboratory were responsible for triggering the collective communication process, as those we interviewed sometimes made contradictory statements about how this group effort was initiated.¹² It seems likely that the scientists responsible for launching the communication project may have been specialists in the geology of resources who objected to social contention. These scientists suggested organizing a seminar to “take stock of the situation” so that they could clear up “certain discussions at the laboratory.” Some

scientists postulated that a consensus among colleagues was necessary to ensure the scientific neutrality of the laboratory in the eyes of the public. But others challenged the possibility of neutrality because the issue of EESG had never been previously debated at the laboratory:

I think part of the conflict was possibly due at the beginning to this situation and to the hidden conflict which already existed internally at our place of work. (FG, E, 30')

From then on, the scientists whose values and opinions differed from those of the initiators decided to “get involved” and make the controversy more explicit at the laboratory, which revealed the “positions of those who were ‘for’ and ‘against’ fairly quickly”:

So in the end, EESG is involved in the controversy on two different scores . . . because of the resources aspect, which we’ve just spoken about, and the risks aspect. And we’ve already seen the differences of opinion between colleagues who are working with the oil companies and those who aren’t. (iH, 6')

I can definitely say that there have been some . . . some . . . intense e-mail exchanges. (iE, 9')

In fact, during the weekend before the seminar, about “350 e-mails were exchanged,” which reflects the strength of their personal involvement.

The preparatory seminar for the joint communication project. All the researchers questioned felt that this seminar was the starting point of the group’s effort to inform the public about the EESG controversy. On January 25th, 2011, more than half of the scientists in the group (50/90) were present on the premises of the Geoscience Laboratory in Montpellier. The seminar lasted for 4 hours. One speaker asked about the “message we want to get across to the public and the decision makers.” Other questions were raised about the epistemic aspects of the controversy mentioned in the scientific summaries presented, such as the properties of the resources, the reserves available, and the fracking methods it was proposed to use. Five participants were chosen to give a lecture on “the basis of their expertise and their wish to contribute to solving the controversy.” It should be noted that at this stage, little mention was made of the environmental risks, especially those affecting the water resources. A member of the Hydroscience Laboratory, the only researcher from outside the Geoscience Laboratory, was therefore invited to attend the meeting. The fact that two other scientists from other laboratories

were excluded from the meeting was said to show that the research group was “closing in on itself,” but this was explained as follows: “We remained closed because we wished to keep things ‘to ourselves’ and ‘in the family.’”¹³

In the second stage, a work group was formed to draw up and communicate the group’s assessment of the situation. Although the original research group wished to remain closed during this preliminary seminar, the laboratory made a genuine effort to open up when producing the reports to be presented to the public. For example, this group consisted of not only the heads of teams but also all “those research scientists who were interested.” In the end, the work group managed to get about 15 people together. After some intensive e-mail exchanges (including more than 100 messages), it took the members of this editorial board only 4 days (from January 24 to 27, 2011) to draw up 11 successive versions of the summary document and publish the final version online.

We noted that the editorial board in charge of producing the public statements was mainly set up on the basis of implicit rules adopted during “informal discussions” that were held “here and there” about the legitimacy of its members as well as their availability and their motivations. In particular, some scientists who wanted to express their point of view about the controversy asked to join the editorial group, including some of those who were particularly concerned about the environmental risks:

It was after this meeting that I asked to be put on this commission to work on the leaflet because I didn’t want there to be a shift towards everybody being in favor of SG. (iC, 29’)

From collectively claimed neutrality to the neutralization of individual opinions. The statements produced by the group addressed questions of two kinds: as to whether the economic context was favorable for working the shale gas reserves and what environmental hazards were likely to arise. It is worth noting that the space allotted to these two opposite groups of arguments was perfectly well balanced in terms of both the number of pages devoted to each point of view in the written final report and the time allotted to both sides of the question in the slide show and its oral presentation at public meetings. The four signatories and the contacts mentioned at the end of the slide show, like the choice of speakers at the public meetings, likewise showed an even distribution between scientists specialized in environmental hazards associated with the aquifer and scientists specialized in working the resources.

Some of the scientists interviewed agreed that the expert report and the slide show produced showed the neutrality claimed by the group. They were rated “excellent” (iD) because they examined all the points at stake as well as

the links between the exploration and extraction of shale gas reserves. Likewise, researcher F felt “fairly comfortable” with the document produced. However, he regretted that this overview placed too much emphasis on “personal feelings.” Similar criticisms were made by several other scientists, who objected that in this group effort, some colleagues “let their personal opinions show through” (iG, 18’) or “went beyond the limits of knowledge and scientific caution” (iB, 6’), whereas some other scientists felt the group had produced a report that suffered from a lack of commitment:

In the end, we were very jumpy about what the pamphlet said. . . . In the long run, we might be reproached for not giving enough information about the risks. (iC, 6’)

It turned out that the negotiations over people’s respective opinions, which were acted out in the form of a confrontation, ended up by taking the environmental hazards associated with fracking more seriously into account than at the outset.

Most of the research scientists who took part in producing the expert report were aware that no consensus had been reached that could really be qualified as neutral. In addition, when we met them again to conduct the focus groups and told them that we interpreted their work as a process of neutralization of contradictory opinions rather than an attempt to reach a neutral consensus, most of them agreed with this interpretation. One of the scientists expressed this by describing the evolution of the report, which tended initially to favor exploration but underwent a kind of “rebalancing” toward greater awareness of the environmental hazards involved:

We produced an average. (iH, 3’)

It happened relatively . . . correctly . . . I mean properly, courteously. But it was funny, because there were some people “for” or “moderately for” SG who were trying to decrease the emphasis on the . . . SG hazards . . . [laughter] and there were those who were against SG who were trying to maintain or increase the attention paid to environmental problems. It all happened in a way . . . sort of, well, a bit under pressure. (iH, 36’)

Under these conditions, how can we explain the fact that these scientists continued to work on their joint production of expertise?

An apparent paradox. To explain the apparent paradox that these academic research workers succeeded in communicating their expertise despite the

existence of extremely strong differences of opinion, we suggest that the factors responsible were not only the process of neutralization of the scientists' discourse but also their shared values, namely, the scientificity of their expertise and their social responsibility, as mentioned above, and the regulatory effects exerted by the head of the laboratory.

One member of the managerial staff coined the phrase "family gatherings" to describe the dynamics of the communication group they had formed:

There's a kind of stagnation, like those difficult family discussions that you never manage to have, and you know they're there, and they spoil all your family gatherings, but you just can't begin them because nobody's ready. (iK, 56')

Nonetheless, managing to run a communication group such as this one dealing with a socioenvironmental controversy has obviously left marks on the laboratory. These marks, which are reflected in the very dynamics of the researchers' ideas about the relationships between science and society, are all the more painful as they have led to a loss of confidence in some members of the research group:

Some people . . . felt betrayed by the common decisions made by the laboratory in the report. (iK, 53')

Some tensions were palpable within the self-appointed research group that had decided to communicate its expertise to the public. But throughout the process of producing the statements to be announced to the public, the risk that the communication group would split up was constantly handled with care. This no doubt explains why the spirit of reflexivity that occurred on the individual scale among the scientists we interviewed was not really adopted collectively and expressed formally in the group as a whole. The same can be said about the researchers' claimed neutrality, or more specifically, about the neutralization of the opposition between individual viewpoints. Besides, the researchers' individual viewpoints were largely implicit in most cases. No attempts were made to explain everyone's individual opinions. In this respect, the opinion given by K about the dynamics of the group assessment was rather optimistic:

Looking back, it's been an opportunity for the lab to realize that it can stage debates internally and survive these debates. (iK, 52')

Some of the scientists involved expressed their feeling of "frustration" when their discussions were stopped in April 2011 because the "politicization" of

the debates seemed to be increasing and even more so when the government tried to stop the controversy by suspending the shale gas exploration permits previously issued.

In view of the strong interactions that occurred at this laboratory, whose members were striving together to inform the public, we wondered what particular attitudes were adopted by the scientists during this unusual experience.

How Did the Individuals Manage to Adapt Their Own Positions to the Collective Stance?

Freedom of individual expression and self-censorship. Whether they were given a chance to speak officially or not, most of the researchers we met had taken part in the public information meetings. The scientists working at this research unit were free to take part in the controversy by speaking as individuals. The research workers interviewed therefore made the distinction between acting as spokesperson for the laboratory and speaking on their own behalf.

A few researchers kept right out of the process of drawing up the group assessment because this collective effort did not live up to their expectations and the documents produced showed either too much or not enough commitment to the conservation of water resources. One of these scientists (D) spoke on his own behalf to suggest “bringing together scientists, researchers, and the population” by mobilizing local politicians and territorial organizations to convene public meetings. His idea was to

put forward colleagues who were more able than me to present the relevant scientific information at stake . . . but I took the personal initiative of speaking in front of official representatives. (iD, 8’)

Some other scientists made direct personal statements in public about EESG, thus asserting their personal freedom as well as escaping the conflicts liable to arise with colleagues:

I intervened as an individual . . . as a citizen-scientist, but not as a laboratory spokesperson. (iC, 10’)

Another group of scientists who participated in the collective production of the public reports attended public meetings but refrained from speaking at them:

My position was that I tended to be in favor [of fracking], but as this was not a very popular point of view, I decided not to say anything. (iA, 9’)

My voice would never have been heard in this context. (iF, 9')

I attended the meetings and I meant to speak, but the way the debates were going, that was absolutely impossible because I might have been lynched. (iB, 16')

This individual self-censorship was therefore attributable to the hostility expressed at some public meetings toward arguments in favor of working the shale gas resources. Whether or not they had spoken in public, the researchers who had attended public meetings all had the feeling that the audiences they encountered perceived science and scientists very negatively. Some of them felt they were "not at all highly respected." They described the climate of "distrust" that had developed via the social criticism of technoscience. The audience was sometimes said to have been "aggressive" and "skeptical" toward scientists. However, one of them said he was glad that this controversy had enabled the public to take an interest in his fundamental research work in the field of hydrology.

The point of view of the scientists acting as spokesperson for the group of experts. Researchers G, J, and K were the main people responsible for presenting the group report at public meetings and via the media. The choice of these spokespersons resulted from an implicit decision-making process, which was mainly carried out by the group leaders.

During the focus groups, the scientists were given an opportunity of discussing their individual points of view about the problems involved in presenting the group assessment. The concepts of "betrayal and trust" became a central point, as shown by the following exchanges:

J: When I'm invited to speak, I always remember to say, this slide show was prepared in collaboration with other research scientists, et cetera. But, from then on, I'm a bit embarrassed because I'm thinking, But aren't you really betraying your colleagues' trust?

G: No, there's no question of betrayal once you've decided that you're only presenting facts, giving the references of the papers you mention each time.

J: Yes but it all comes out. In the end I say to myself, But when your colleague gave you this slide show to present, did he expect this type of discussion to occur afterwards? It makes me wonder . . .

I: In my opinion, there's no problem.

G: As far as neutrality is concerned, I think that as long as you've agreed not to say, "I'm for or against this or that," then there's no problem. As long as you

obey that rule and you're aware that you're presenting a slide show in which the logos of both labs can be seen, you are bound to be aware that these two labs are both involved, and there's a degree of trust between us. (FG, 100')

Some of the ideas expressed by these scientists about the question of neutrality differed considerably. According to spokesman G, a dualistic representation of the relationships between objective facts and subjective feelings, between scientific knowledge and opinions, does not leave room for "betrayal"; whereas spokesman J took this frontier to be permeable and the question to be open-ended. The differences of opinion therefore gave rise to problems as to how to reconcile individual viewpoints with that of the group as a whole in its joint communications. The trust invested by all the members of the research group in their spokesmen despite the existence of individual differences of opinion seems to have been a decisive factor contributing to the angle from which the group report was presented.

These scientists seem to have managed to overcome the difficulties posed by tensions between individual and group stances by adopting a set of mutually agreed common rules. In any case, this is what J meant when he referred to "a feeling of depersonalization when speaking as a group." At the beginning, J presented himself as being affiliated to a laboratory and acting as a spokesperson for a work group. His position subsequently evolved, however:

Next, I tried to explain my position as a citizen, respecting neutrality, which isn't really possible because our ideas are obviously biased. The vocabulary I used was obviously . . . going to show . . . since I'd come along with my university cap on. But then, as the questions progressed, I began to speak as a citizen, and I was saying to myself, "So it looks like you're switching sides during the meeting. You're creating problems there!" (IJ, 21')

It can be seen from these statements that the experience of conveying information to the public provided the spokesmen with an opportunity for engaging in reflexivity, on both the individual and group scales, about their role as scientific mediators and sometimes about their social responsibility.

Discussion

The unusual case of scientific communication analyzed here raised two main points worth discussing. First we wondered how socioscientific controversies and the public statements made about them may trigger reflexive processes among the scientists involved, providing them with a kind of feedback

information about issues such as their social responsibility and the neutrality of their positions. Second, we focused on whether scientists' collective presentations and the practices involved in drawing them up are worth studying in the field of science communication research.

The present study brought to light three levels at which a socioscientific controversy is liable to trigger reflexivity among the protagonists. On the first level, a socioenvironmental controversy itself is likely to trigger reflexivity. On the individual scale, it made the scientists update their knowledge about how the dynamics of the situation under debate had evolved and, of course, about how their position as producers of scientific knowledge was likely to be mobilized for epistemic purposes. This reflexivity resulted in tensions between their individual opinions and the practical applications to which their findings might be put, which revived some long-standing differences of opinion between the members of the laboratory about the social role of geology. It should be emphasized that in this particular context of fracking technology, these old quarrels between geologists were revived because the facts relating to the fields of seismology and hydrology, the chemicals used, and public health tended to point to opposite conclusions. From this point of view, the scientists' recourse to public speaking could be interpreted as a means of solving or updating scientific conflicts, as suggested by Weingart (1998).

On the second level, presenting the public with scientific information about EESG led the scientists to reflect on the social circulation of the knowledge they produced. In the present case, a form of "reflexivity through verbalization" (Jurdant, 1993) was at work among the scientists engaged in mediating their findings. This reflexivity also operated on the collective scale because the researchers discussed their communication skills and the reasons why they felt they had to speak in public. This is a relevant point because social scientists have observed an increase in the mediation of science, involving interactions between scientific and lay journalism (Peters, 2012; Rödder, 2008). In addition, the fact that scientists used to frequently delegate the task of mediation to professionals can lead to some homogenization of speech and some autonomization of the communication practices adopted (Babou & Le Marec, 2008). In the present case, on the contrary, these scientists, who drew up their own reports without having recourse to the journalists and other actors usually responsible for popularizing science, felt that speaking directly to the citizens was an integral part of their mission. These scientists had no need to be legitimized by the mass media, contrary to what often occurs (Peters, 2008). By communicating with the public, they were able to put their social responsibility to the test, and hence to measure its practical limitations, especially those due to the difficulty they had in reaching an axiological and epistemic consensus.

This is also certainly why the group of spokespersons had fairly little scope for reflexivity. Its members did not explicitly discuss the reasons why their group efforts were justified, such as the neutrality they might be assumed to show because their statements were based on facts. Dietz (2013) has argued that if scientific mediators are to inform public decisions about socioscientific dilemmas, they must be competent in terms of social values as well as scientific facts. The results of the present case study tend to confirm that this is the case, but they also suggest that one should reconsider the classic epistemological opposition between facts and values, that is, knowledge and opinions or *episteme* and *doxa*. The sociologist Bourdieu (2002) has discussed the issue of scientists' reflexivity about their neutrality in public spheres. Bourdieu criticized the dichotomy artificially set up between *scholarship and commitment*, that is, between producing scientific knowledge and publicizing it. He argued in favor of *scholarship with commitment*. From this point of view, the mediation of scientific knowledge should be a socially committed activity, especially in the context of socioscientific controversies of the kind existing here.

The third level of reflexivity, which was that on which we focused most closely, was that of our own approach to research. The individual interviews and especially the focus groups we conducted constituted a series of occasions on which this reflexivity was expressed. The ideas held by the scientists interviewed about the relationships between science and society were clearly based on dynamic representations, which were updated in various communication situations (at informal laboratory discussions and meetings, public meetings, during the individual interviews and focus group interviews).

Last, it is worth discussing why the approach used here seems likely to be of interest in the field of science communication, since the scientists' practices, discourse, and representations were examined not just at the individual level but also at the collective level.

Most quantitative and qualitative studies on scientists' mediation practices, discourse, and feelings (about the public, the communication of scientific findings, and the role of the mass media, their own role, and the role of science in society) and their motivations for communicating with the public have focused so far on the individual level. This may be because research workers' communications are usually based on their own individual practices. This is not a trivial point; it is worth examining more closely, especially as scientists' work is generally thought to be necessarily a collective affair.

In our opinion, studies on scientists' collective communications focusing on their real practices give an interesting picture of the plurality and the dynamics of the processes actually involved in these practices. It enables us to go beyond simply classifying individually declared practices (depending

on the discipline or the medium of popularization involved), which does not show up the social significance of these practices. Studies on individual scientists' declared practices often stress the subjects' reluctance to communicate with the public in order to improve their public image or increase public support (Jensen, 2011; Mizumachi, Matsuda, Kano, Kawakami, & Kato, 2011) rather than on questioning the social reasons for scientists' public statements.

However, qualitative studies on research workers' collective communications can be complementary to those focusing on individual scientists. At the individual level, for example, we confirmed the individual scientists' picture of their role as mediators ("experts," "research managers," "guardians of science") described by Horst (2013). Depending in the context in which their findings are mediated (at public meetings, press and TV interviews, official commissions, or research interviews), individual research workers can shift from one ideal type to another. But it also seemed to be worth analyzing how these ideal types can come into conflict, be compatible, or neutralize each other at the collective level, as we have illustrated by pointing out the processes at work among "experts" and "guardians of science" in the present case study. The findings presented here also confirmed that scientists can support social opposition to sociotechnical innovations and act as "citizens like any others," as suggested by Boy (2007) in his quantitative study. But collective approaches to scientists' actual mediation practices make it possible in addition to grasp how scientists renegotiate their social responsibility.

Studies on scientists' collective mediation procedures also suggest some new questions that would be worth investigating in the field of science communication. Studies in this field could focus on several aspects of communication processes, such as shared values, individual versus collective communication stances, and the modes of collective regulation (between autonomy, collegiality, and top-down regulation) that do not exist at the individual level. In this context, the regional setting is another meaningful aspect that counts when scientists are engaged in communicating information about a socioenvironmental controversy. We would also like to stress the fact that scientists' reflexivity can be particularly strongly mobilized when they are working as a team, motivated, as discussed above, by the need to present findings that may help to clear up a controversy. In line with the reflexive questioning presented by Jasanoff (1996) about the constructivist science studies, the latter point suggests that it would be worth conducting further studies on the communication of scientific findings and their political and social circulation in the context of social controversies.

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Notes

1. In the middle of the Eighties, participative procedures were first used by the Danish Board of Technology. In the French context, the first *conférence de citoyens* dedicated to the use of genetically modified organisms was organized in 1997.
2. In France, this movement developed with the *Etats Généraux de la Recherche* in 1982, when the government launched a policy of sustained popularization. The institution in 1991 of a *Fête de la Science* (National Science Day) was emblematic of this trend.
3. Following the public meeting at St-Jean-du-Bruel in the Aveyron, the *Midi Libre* (December 21, 2010, p. 2) published an article titled “Larzac Shale Gas Deposits: Give Us Phosphorus Before You Bore Us” with a photo of the European ecologist deputy J. Bové, who claimed that apart from the impact on the environment, this was “a problem for democracy.”
4. For example, according to N. Kosciusko-Morizet, the minister of ecology, sustainable development, transport, and housing, in the speech she gave at the National Assembly on March 29, 2011, the demonstration that took place at Villeneuve de Berg on February 26, 2011, was attended by “10,000 to 20,000 people.” In the United States, there was less social opposition to the exploration and extraction of shale gas (EESG) than in France; in Canada, the dynamics of this controversy were also different (see Batellier & Sauvé, 2011).
5. In a recent review of the subject, Papon (2014) focused mainly on scientific debates in the United States, where shale gas deposits have been worked for more than 10 years using hydrofracking methods. Beyond the claimed economic benefits, some controversy has arisen about the uncertainties. In Europe, there exists some doubt about the size of the existing deposits and how quickly those identified so far will be depleted. Other concerns have been voiced about the environmental and public health risks associated with this industry, such as those resulting from groundwater pollution by toxic chemicals, the climatic effects of methane contamination of the atmosphere, or even the risk of triggering earthquakes in the neighborhood.
6. During the first 3 days after being published online, this document was downloaded more than 5,000 times (retrieved September 10th, 2014, from <http://www.oreme.univ-montp2.fr/spip.php?article36>). This was the first-ever French assessment published on the subject.

7. In this research project, we wanted to adopt a similar symmetrical stance to that initially proposed in the field of the sociology of science. We therefore wanted particularly to deal fairly with the arguments on both sides without giving an impression of axiological neutrality about the controversy under investigation. We did not want to stir up any arguments about EESG beforehand unless the scientists themselves triggered them.
8. One woman and 12 men ages 35 to 65 were interviewed; nine of them were involved in the production of collective communications. These scientists were all professors or associate professors at the Montpellier 2 University of Science and Technology (UM2) or occupied equivalent ranks at the CNRS (the French National Center for Scientific Research).
9. The code *iX* denotes individual interviews with researcher X, and the focus groups are denoted FG.
10. The institutional funding authorities reacted differently to this project launched by members of the Geoscience and Hydrosience Laboratories. Right from the start, UM2 wanted to take part in this effort of reflection, claiming to be a “major actor in environmental expertise,” whereas the CNRS refused to participate because it was already involved in “discussions with the oil groups” and wanted to avoid any “confusion between roles” (iK, 18’). Later on, the CNRS wanted to take a part in the communications presented by geologists and hydrogeologists, some of whom were affiliated to the CNRS. In the end, the CNRS logo was displayed only in the slide show because it was signed by two research scientists who belonged to this institution.
11. The contents of this final report were as follows: (a) “The Context in Which Exploration for Shale Gas Was Envisaged,” (b) “Exploration and Excavation in the Languedoc Roussillon Region,” (c) “The Geological Context and Water Resources in the Areas Possibly Explored,” (d) “What Environmental Risks and Health Risks Are Liable to Be Associated With Working These Resources?” (e) “Who Are We?”
12. The majority of the hydrogeology specialists working at the Hydrosience Laboratory were “clearly against working the SG reserves” (iJ, 61’).
13. Some of the people who attended this work group were against this spirit of closure (one of them left the meeting for this reason) and condemned these exclusions on the grounds that they were contrary to the collegial spirit of the university.

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