Investigating lay understanding and reasoning about fusion technology

End-of-project Report

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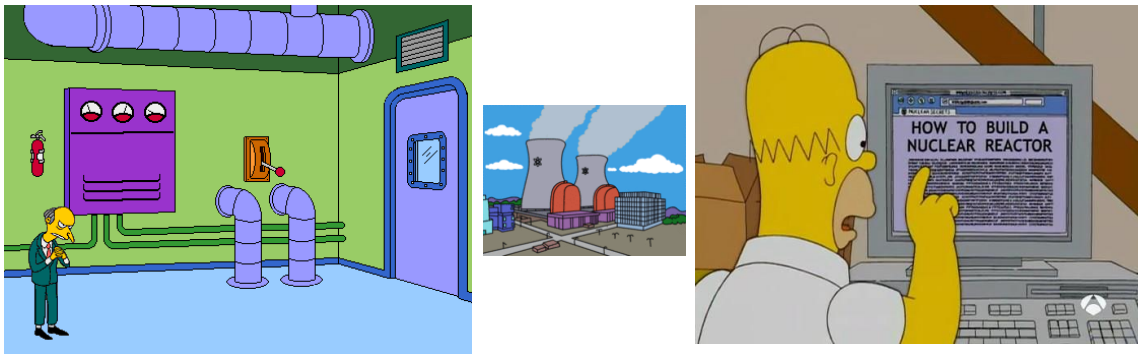

Executive Summary on the Lay Understanding work for EUROFUSION

- → Background and objectives
- → Method
- → Summary of findings

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Background and objectives

Previous research into the social perception of Large R&D Programmes has shown that there is no such thing as a uniform and unchanging "public opinion" towards nuclear fusion. Fusion is not well understood among the lay public and, consequently, historical associations with the fission programme have a dominant role in shaping views towards fusion, where they do exist (Prades *et al* 2007; 2008). In order to enhance the understanding of lay publics, they need to *engage* with information about the specific technology. To provide such information in a suitably balanced way, and to promote engagement with it, is a non-trivial problem, and indeed a research problem in itself. The overall objective of this work was to produce resources that **support the design of practical ways of improving communication about fusion, and an enhancement of the quality of lay engagement with sources of information about fusion**.

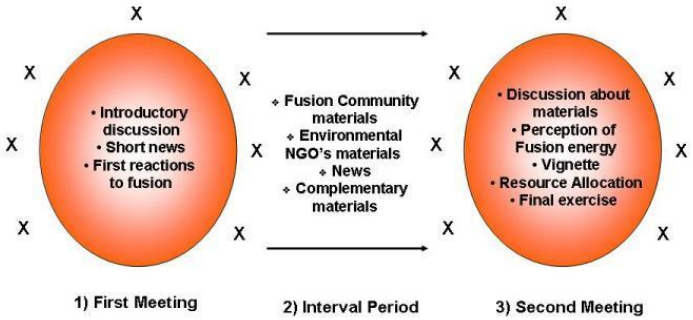
We developed a **hybrid methodology** to accomplish such process of engagement, *and* to gain insights into changes in lay reasoning as people proceed through a learning and discussion process. This document summarizes the **main findings** of the implementation of the discussion and learning process in the light of the **research questions** that guided our efforts:

- → The effectiveness of different informative materials in promoting understanding and engagement among lay publics
- → Whether, and if so how, modes of reasoning about fusion change with increasing levels of knowledge about the technology
- → The role of various interpretative resources in such processes of practical reasoning: lay logical devices; pre-existing knowledge, in particular the "brand" associated with the technology (nuclear stigma); media narratives and fantasies, etc.
- → The relationship between increasing knowledge about fusion and its acceptability
- → The suitability of the group-based method to generate an appropriate learning and discussion process

The document ends with some observations in terms of **practical implications for future communication strategies.**

Method

- → **Hybrid discussion groups** combining **research and engagement** with an interval period to support the assimilation of technical information and to promote learning and deliberative process.
- → Reconvened Focus Groups (RFG) similar to Focus Groups (FG) in nature, but allowing the presentation **of new information materials** and its discussion in a structured way (Bloor,2001)
- → Promotion of **high density inter-participant interaction** by the use of stimulus materials including vignette scenario (Huges, 1998), and component parts of PSM (Rosenhead & Mingers, 2001)



Age	18-25	26-40	40+	Socio-economic status
	Group 1	Group 2	Group 4	**AB**
	Group 3	Group 5	Group 6	**CD**

→ The method concentrates on the **use of ordinary language**, and the elicitation of **patterns of lay practical reasoning** (rather than pre-framing the issues in terms of technical categories) (Horlick-Jones, 2005; 2008; Myers, 2007; Timotjevic & Barnett, 2006)

Summary of findings

The effectiveness of different informative materials in promoting understanding and engagement among lay publics

To promote *engagement* with the technology at the end of the first meeting of the discussion groups, participants were given a pack of ***informative materials*** about fusion. During the interval between the meetings participants worked through the information at their own pace. The second meeting of each group started with an initial discussion on the informative materials that participants had looked at during the interval period.

Materials by fusion community:

- Fusion: Energy for the future (2005) (EC) (4 pgs. brochure)
- Cleaner Energy for the future. The development of fusion energy (2004) (EFDA) (8 pgs. brochure)
- Fusion, an energy option for the future' (2007) (EFDA) (flash CD-ROM)

Materials by environmental groups:

- ITER: A dangerous and expensive fantasy (Ecologistas en Acción) (2 pages article)
- The sun is the only fusion reactor we really need (Greenpeace) (4 pgs. article)
- The fusion option would aggravate climate change (Greenpeace, EA, GCTPFNN, WISE) (2 pgs. article)

Materials by the media:

- Story of a coincidence (La Vanguardia, 26th February 2006)
- The starting shot for the fusion reactor ITER (El País,22 November 2006)
- ITER starts his way towards a new energy in Barcelona (La Vanguardia, 29th June 2007)

Important efforts were devoted to guarantee a proper selection of the available information materials on fusion (in Spanish) to be given to our participants.

→ ***Materials produced by the fusion community*** were perceived as strongly emphasizing the advantages of fusion (as anyone could expect), and - importantly - to omit the negative elements. Materials were also perceived to be "too technical" and difficult to understand.
→ ***Materials produced by the environmental groups*** were perceived to be excessively negative, and with an important ideological slant that seems to obey political interests (i.e., the antinuclear bias). Most participants expressed a favourable opinion of this material in terms of its comprehensibility *when compared* to the fusion community's materials; even though, for some other participants these materials were highly technical and difficult to understand too.
→ Participants did not reach an agreement on their assessment of the ***materials produced by the media***, i.e., the written press articles. For some the news articles were the most objective – as they omitted ideological or vested interests; while for others they were positively biased too.

In despite of their divergences and perceive complexity, informative materials enriched group discussion and allowed participants' engagement with fusion. Participants made use of both, the positive statements from the fusion community and the negative statements from the environmental associations, in their efforts to give meaning to the fusion technology. Materials from the environmental groups seemed to be more widely used than materials by the fusion community.

The lack of agreement among the different informative sources lead to confusion and perplexity about what fusion is, how it works, and whether it is a good or a bad thing. The level of confusion was so strong that participants requested an impartial and independent vision of fusion, as the one by a committee of external experts. Importantly, the dilemma on where to find "the truth" about fusion technology was rarely resolved in favour of the fusion community

Whether, and if so how, modes of reasoning about fusion change with increasing levels of knowledge about the technology

Our participants were taken on a learning process, in which most of them moved from a position where they had no awareness of the existence or nature of fusion, to one in which they could at least engage in some sort of informed discussion about the technology. The question then arose: did they deploy the same sort of rationality throughout this learning process, or did it change as their level of awareness and understanding increased?

→ At the start of the process our group participants expressed a ***universal and widespread lack of knowledge*** about the fusion technology and they had strong difficulties to "imagine" fusion or to relate such "distant" technology to their everyday life and understandings. At these first stages of the learning and discussion process ***"brand-based reasoning"*** did play a significant role in the participants' efforts to give meaning to the fusion technology. The most relevant brands seemed to be: the "nuclear brand" and the "new brand", and, importantly, both brands were quite stable all along the process

→ As participants get to know more about fusion, and more precisely about the *"contextual issues"* of both the technology and the ITER project, ***structural- calculative practices*** gained prominence. Consequently, participants tried to obtain conclusions on the technology on the basis of this minimal information. Participants used essentially *"contextual issues"* (ITER members; ITER location; ITER as a prototype; general ideas about levels of investment or time frames; global context in which ITER is framed – climate change and the energy problem, etc.) to address questions such as the safety of ITER, its chances of success; its dangerousness and so on. This extensive use of structural – calculative reasoning was to be expected in low-information environments.

→ **Structural calculative** *('if' it is in France it is SAFE)*

G3-S1:
M2. And would this be dangerous? … Because, naturally, if it is very good energy … but … the problem is that it's dangerous, so … even if it's very efficient, if it's dangerous then it's not so good.
M3. ***If it was dangerous they wouldn't have it in France I think.*** They'd have it in another country in the third world. Like they've always done with atomic tests and so on, they've done them in the Pacific ….or in places like that…
M2. In the United States they probably did them...
M3. ***Yes, but the European Union … I don't know … I'd say that if it's in France...***

→ **Grounded in technical knowledge** *('mechanisms' that makes it SAFE)*

G5-S2
M3. It's like, for example, with this kind of energy, from what I can see here, there can't be more accidents like Chernobyl; that was fission, and that is reactions followed by reactions, which can go out of control ... that's what it says, here… when you see that there could be ... pum… you turn it off and that's it ... ***it's a small safety mechanism …unlike with other types of nuclear energy.***
F3. You know, I imagine that when they build nuclear stations they don't think in terms of there being this failure...
M3. No of course, in the old nuclear stations if there is this failure it can't be avoided.
F2. Here you can switch it off.
M3. Here ***you can switch it off,*** if you have any doubts … disconnect and end of story.

→ **Reasoning grounded in technical knowledge** was expected to gain prominence as participants kept on gaining information and familiarity with the technology. In most groups, participants had *strong difficulties* in coping with the technical knowledge. G1 and G2 were quite competent in handling the technical details and they did use them to support their arguments in the second meetings of the groups.

There were indeed ***differences among groups:*** younger people with higher socio-economic status were the most competent in handling the technical details of the information materials, and thus the ones that relied most in the reasoning grounded in technical knowledge. On the other hand, groups with lower socio-economic status were the most creative in using structural-calculative practices. As the stability of the different modes of reasoning might differ, these results have important ***implications for communication strategies around fusion***.

The role interpretative resources in practical reasoning

→ The role of the "nuclear label" was quite complex, as it shaped a dual conception in terms of dangerousness: fusion as a non dangerous innovation VS fusion as a highly risky and feared technology. Thus, the '***nuclear brand'*** (negative resonances in terms of fear, stigma, etc.) was relevant but – in our view – it was not as prominent as one could expect.

→ All along the process ***fusion was shaped as a "new" technology***. This "new" label included different dimensions: some of them were developed in opposition to the *old* (and bad) fission technology (fusion as a safe and less polluting energy source), while others were based in the technical or contextual knowledge about fusion that our participants assimilated during the process (fusion as top international research; as a pioneer enterprise in organizational and collaborative terms; as the endless energy for the future). This 'new' brand also has a hint of *fantasy* about it, in the sense of new wonderful innovations that go beyond reasonable expectations.

Both brands - the 'new' and the 'nuclear' - were quite stable all along the learning and discussion process.

Pre-existing knowledge and experiences were also key elements in group discussions. Knowledge about the nuclear industry, especially related to risks and safety, knowledge about energy innovations, hazardous facilities, environmental problems and energy issues related to daily life was used by participants to contextualize fusion energy. Narratives from the media or images from films (i.e., *Erin Brockovich*, *An Inconvenient Truth*, *Titanic* or the *Simpsons*) were also used by participants in the process of making sense of fusion.

The relationship between increasing knowledge and acceptability

Group discussion offered a good opportunity to get a deeper knowledge of the ***elements underlying public acceptance*** of fusion. The evidence suggests that when participants are exposed to information about the benefits and risks of fusion energy, risks tended to dominate the discussion. Benefits seemed to be clearly perceived by participants, which is an important factor in acceptance of fusion, but they almost remained aside in the second group discussion. Participants tended to discuss about the potential risks and costs of fusion energy, like radioactive contamination, safety issues or the long term frame. In this sense, psychometric factors such as catastrophic potential, dread, uncertainty and familiarity seemed to have a clear influence in how participants perceive fusion.

Different ***attitudes towards fusion*** were expressed by participants. Ambivalence seemed to be the normal output of confronting information from scientists and environmentalists. Considering benefits and risks, for some participants it was difficult to form a consistent judgement about fusion. Other expressed a clear acceptance of nuclear fusion, based on perceived benefits and a prior positive attitude towards scientific and technological programmes. Conditional acceptance seemed to predominate at the end of the sessions, and it was based on the acknowledgment that although fusion may have important benefits it would only be accepted it if it does not affect negatively the development of renewable energy and risks are minimized. Finally, some express a clear rejection towards fusion. A high risk perception, preference for other technologies, lack of trust and prior attitudes towards scientific and energy issues seem to influence this attitude.

The suitability of the group-based method to generate an appropriate learning and discussion process

The group-based design worked well and showed its potential to generate quasi-naturalistic collective discourses, and to promote a rich discussion and learning process among our research participants. It has proved its potential to stimulate discussion, generate discourses and help latent discrepancies to emerge.

The hybrid method has simultaneously allowed a deep and meaningful analysis of the lay perceptions of nuclear fusion together with the generation of a further lay engagement exercise with the technology. Thus, despite of the strong difficulties that most of our participants had with the technical details included in the stimulus materials, in our view the method has clearly shown its potential to generate a fruitful learning and discussion process.

Finally, the method has a noteworthy capacity to generate a significant amount of rich qualitative and quantitative data.

Conclusions

Our analysis of both the lay perceptions of nuclear fusion and the ways in which lay citizens "engage" with information material about the technology presents clear ***implications for future communication strategies*** on fusion. Here we include some examples on the practical implications of our findings:

→ The assessment of the effectiveness of the information materials about fusion could provide useful insights for the improvement of future information materials.

→ The better understanding of the lay concerns and how they emerged in collective discourses could also contribute to better address them in the future.

→ The identification of how different publics use diverse modes of reasoning about fusion might also have relevant implications, providing useful insights not only in terms of group differences but also in terms of the stability of the different modes of reasoning.

→ The pioneer characterization of the "fusion brand", with its "new" label, could be relevant in the elaboration of future messages about fusion.

→ Recognizing the key role of "low information rationality" in the sense making about fusion might be a crucial finding for future attempts to establishing a constructive dialogue with citizens

→ The research itself has been an important experience in terms of public engagement.
