

## **Pilot multi-method study to explore evaluation options of the Fusion EXPO travelling exhibition Findings from Spain**

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### **Executive Summary on the Expo pilot study for EUROFUSION**

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## Background and objectives

The Fusion Expo is a travelling exhibition owned by the EU/EFDA and it is designed to provide a clear introduction to the technical fundamentals of fusion energy which is accessible to the general public. It also provides information on Europe's fusion research facilities, in particular the ITER project, and the future prospects of a fusion power plant. Therefore, rather than simply providing technical details of the science of fusion, it also sets out to make the case for fusion as an environmentally acceptable, safe, and environmentally sustainable energy technology.

Since the exhibition was first designed, a considerable volume of research-based evidence on public understanding of, and reasoning about, fusion power has been assembled by EFDA-SERF funded research. In addition, recent scholarly research has provided important insights into the actual functionality of science centres and museum-based science exhibitions. In the light of these research developments, it is timely to **reconsider the design of the Expo**, the ways in which it is used, and its effectiveness.

During 2010 the Catalan Museum of Science and Technology (mNACTEC) located in Terrasa (near Barcelona, Spain) hosted the Fusion Expo (MaxiExpo) from the 4<sup>th</sup> of March to the 2<sup>nd</sup> of May. Thus, we took the opportunity to carry out **a pilot evaluation exercise during March-April 2010**. The study was a *pilot* one in the sense that, at the outset, we were unsure which method, or combination of methods, would be most effective as an evaluation tool. The study was also *limited* in the sense that a full evaluation of the exhibition would include at least some degree of cultural comparison across different geographical locations. Our project was therefore concerned with **a provisional assessment of both the effectiveness of the exhibition, and of a range of methods used in the evaluation exercise**, rather than being a comprehensive evaluation of the exhibition's effectiveness.

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## Methods

Traditional means to evaluate science exhibitions include the use of visitor questionnaires and focus groups. More recent observational work (including the use of video) have provided insights into *actual* patterns of visitor behaviour in real time, rather than providing retrospective accounts of what visitors *say* they did. We drew upon both these approaches, and also included some relatively new methods that have been developed within social and psychological research:

<b>Observational methods</b>	Observational protocol
	Audio/video recording
	Thermographs
<b>Participative methods</b>	Short questionnaire
	Visual methods (drawings & photos)
	Focus Groups

**Participative methods** involved visitors in ‘having something to say’ about their experience of engaging with the exhibition.

We used a short questionnaire, which generated quantitative data on the visitors’ profile, their experience of making the visit, and on the specific technical knowledge that they assimilated. We drew upon some recent themes in social research using ‘visual methods’ to invite visitors to produce drawings or take a photograph to capture something of the exhibition that they found particularly interesting, and to provide a short piece of text (including three key descriptive words) to explain their choice. We also recruited small groups of people to visit the exhibition and then to take part in a group discussion about the experience. These groups had a hybrid social research/citizen engagement nature, so allowing a degree of direct comparisons with earlier work we have conducted into learning and reasoning about fusion by lay citizens.

**Observational methods** included audio and video recording, and ethnographic observations, in which we attempted to capture something of the patterns of behaviour *displayed* by groups of visitors. We also experimented with the use of an infra-red camera that was able to display patterns of bodily temperature among the visitors (‘thermographs’).

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## The effectiveness of the exhibition

The exhibition has two central stated objectives: a) **an educational function** - to promote lay understanding of the technical aspects of fusion; and b) **a promotional or policy-related function** - to make the case for the development and adoption of fusion power.

The design (and use) of the exhibition appears to be based upon what has been termed a **deficit model** within the public understanding of science literature. This would suggest that lay visitors possess a lack of technical knowledge that the exhibition seeks to address. Further, the design seems to link the two stated objectives so that the acquisition of such technical knowledge is regarded as leading logically (as a pre-condition) to support for fusion power in future energy policy within Europe.

However, our findings indicate that:

- the exhibition is poor at engendering the assimilation of technical knowledge about fusion;
- the exhibition is moderately successful in promoting fusion as an attractive potential source of energy;
- support for fusion is achieved by the exhibition’s portrayal of fusion in wholly positive terms, and
- there is a risk of the support being vulnerable to change in the light of information readily available on the Internet, with possibly serious implications for trust in the fusion R&D community.

Our previous work suggests people have considerable difficulty with the abstract and technical aspects of the technology. However, we found that they can use ‘**low-information rationality**’ devices in order to ‘get a feel’ for what is going on *for all practical purposes* e.g. taking a view

on the safety of fusion, its feasibility, whether it's worth investing money in it, etc. This characteristic of formal knowledge about fusion suggests that Fusion Expo needs to be good at relating fusion to peoples' everyday lives. Our evaluation findings reinforce this perspective; with visitors finding Fusion Expo very hard going in terms of understanding and assimilating what it has to say.

**The overall style of the exhibition is relentlessly didactic.** This didacticism was reinforced by the one-way lecturing manner usually adopted by the exhibition demonstrators that we observed. The science education literature suggests there is a need for linkages between observable physical objects and processes, and common sense and formal understandings, to be actively established by means of interaction between teachers and students. In practice, there was little interaction between demonstrators and visitors. Indeed, groups of visitors were observed to adopt a passive, almost reverential demeanour.

Whilst some parts of the exhibition consistently engendered interest, amusement and clear enjoyment, there was little evidence to suggest that these experiences served to promote high levels of assimilation of technical knowledge. Whilst the promotion of enthusiastic engagement may be a pre-condition for promoting understanding, such occasions may simply serve to create transient entertainment, as seems to be the case here.

We note that the Fusion Expo has little to say about some of the **technical difficulties facing the development of fusion**; matters that our previous research respondents found important in gaining a rounded view of the prospects, and potential down-sides (e.g. Tritium contamination, radioactive equipment etc.), for fusion as a potential energy source. This uncritical portrayal was reflected in our discussion groups' deliberations, where participants tended to only see the positive side of fusion: this 'beautiful thing we have read about'. However those views were tempered by a recognition that the whole story turned on trust in the accounts provided by the exhibition, and by scientists and government organisations: 'surprise and hope, but do we really know?'

In line with our previous research, participants adopted **modes of reasoning** that allowed them to draw conclusions about fusion, for all practical purposes, in the absence of technical understanding: for example the sheer scale of international collaboration on fusion research suggesting that 'there's something in it'. However, the lack of technical knowledge was always evident: 'if it's so good, what are they waiting for?'

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## The effectiveness of evaluation methods

The combination of the specific features of the venue in Spain and the inherent difficulties associated with evaluating the engagement between visitors and exhibition proved somewhat challenging.

The museum management stipulated certain requirements in terms of obtaining permission from respondents to participate and to be photographed, video-recorded, etc. These requirements necessitated rather elaborate measures to satisfy the consent requirements whilst allowing data collection from visitors who still were allowed to interact in naturalistic

ways with the exhibition. The resulting dynamics served to create contrasting situations: times when very little was happening and others when everything came together so quickly that considered data collection proved difficult.

Overall, the **participative methods produced more usable data**. Despite proving more problematic, the observational methods displayed significant promise, suggesting the need for more work to be done in developing their application in this context.

The short questionnaire played an invaluable role, as did the discussion groups. The former generated useful volumes of quantitative data, including firm evidence on the exhibition to engender learning processes. Although useful, we concluded that the particular questionnaire format that we used requires a little adjustment. The discussion groups produced large volumes of rich data, which provided important insights into the visitor experience.

On their own, the drawings and photograph exercises produced interesting data, but ideally this data would have been used as elicitation devices in subsequent interviews or group discussions with the 'artists'/photographers. In the event, this extended application was not practically possible. So we used a computer-based technique to examine the patterns of words used by respondents to describe their drawings and photographs. This analysis provided limited, but contained some useful insights in terms of socio-demographic factors.

The extreme contrast between occasions of low activity and those of high activity, and the need to conduct multiple data collection activities during the latter phases, served to sideline the **collection of observational ethnographic data**. Had the video monitoring proved effective, this would have produced a permanent, detailed, record of visitor interaction with each other, and with the exhibition, that could have been analysed in detail subsequently. In practice we encountered a number of technical difficulties that necessitated hand-held video photography (rather than using a fixed camera), and a failure to capture co-ordinated video and audio recordings. Although the video data did prove insightful and important for our analysis, access to simultaneous audio recordings of the videoed occasions, would have allowed extended detailed analysis, creating, we feel, significant insights. We feel confident that the technical problems we encountered could be resolved without too much difficulty. We therefore suggest that video recording is a potentially invaluable component part on future exhibition evaluation exercises.

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## Conclusions

### → The effectiveness of the exhibition

There is considerable scope for the educational function of the Fusion Expo to be improved, by adjustments to the content, style and presentation of the exhibition.

Evidence from our previous research into practical reasoning about fusion suggests that a more even-handed presentation of the advantages and disadvantages of the application of fusion to energy generation would not necessary undermine lay support (where awareness exists) to a significant degree. Moreover, it would avoid the possible vulnerability arising from

the Fusion Expo coming to be regarded as a rather one-sided presentation of the facts, with possibly adverse impacts on the credibility and trustworthiness of the fusion R&D community.

Some of our participants made suggestions about how Fusion Expo might be improved. These ideas included: signposting the logical flow of ideas more clearly, specifying the purpose of the exhibition, including details on certain practical matters like the cost of fusion, making linkages with everyday life, and publicizing the exhibition to a greater degree. Although the text in all the panels was translated to Catalan, our participants recommended the availability of leaflets and videos in “home” languages (Catalan or Spanish in our case), as most leaflets were in English as well as the video (although with subtitles in Spanish).

→ **The effectiveness of the pilot multi-method approach**

Our work indicated the importance of suitably-designed short questionnaires and visitor discussion groups in evaluating exhibitions like Fusion Expo. It also indicated the significant promise of video recording and the need for attention to resolve technical challenges to this means of gathering rich evaluation data. There is also a clear need for cross-cultural comparative work to extend this pilot evaluation.

Methods	Advantages	Drawbacks	Relative cost	Comments
<b>Short questionnaire</b>	Collects large volumes of quantitative data. Comparability.	Doesn't capture nuanced aspects of visitor perspectives and understandings.	€	Valuable method Suitable design required
<b>Free drawing</b>	Significant potential as elicitation device	Time-consuming for respondents (and expensive if honoraria paid). Time-consuming data analysis Difficulties in interpretation.	€€€	Potentially useful. Ideally in combination with semi-structured interviews.
<b>Photo diary</b>	Significant potential as elicitation device	Time-consuming for respondents. Data analysis may be time-consuming. Difficulties in interpretation.	€€€	Potentially useful. Ideally in combination with semi-structured interviews.
<b>Focus groups</b>	Good findings with small number of groups. Effective to tap into wider sensibilities through interaction.	Danger of findings idiosyncratically linked to limited samples of visitors. Time-consuming data analysis Expensive (if honoraria paid). Expert facilitation and analysis required.	€€€	Valuable method.
<b>Observation</b>	Non-intrusive means of capturing actual behaviours.	Potentially very time-consuming for researchers. Researcher time may be wasted if extended periods with no visitors	€€	Valuable method Time consuming
<b>Audio - Video recording</b>	Efficient means to capture actual behaviours. Overcomes potential problem of time periods with no visitors	Relatively expensive equipment. Technically difficult to collect high-quality data. Experience needed. Expert data analysis required.	€€	High potential value, if technical difficulties solved.