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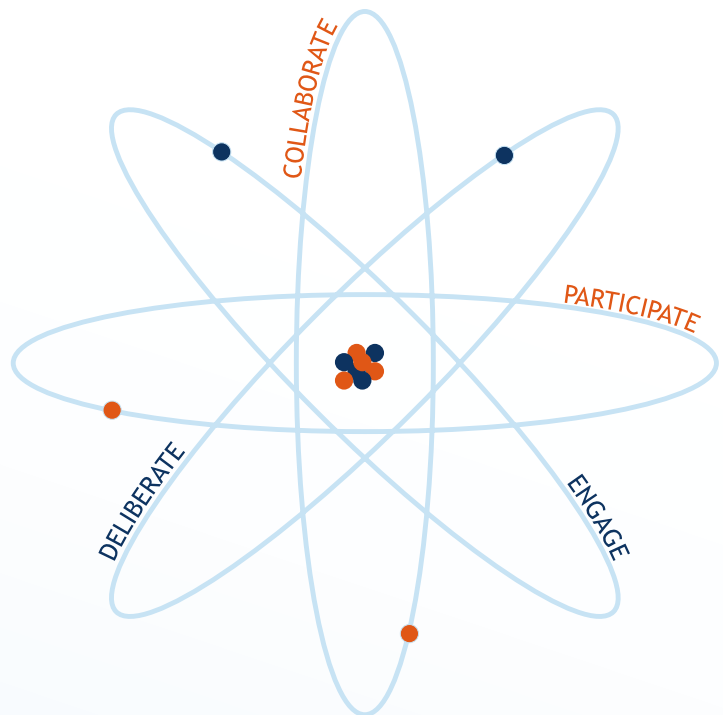
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## Final Report of the NESTA-funded Project



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Email [science-engagement@open.ac.uk](mailto:science-engagement@open.ac.uk) if you would like to know more about the project.

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## Final Report of the NESTA-funded Project

Richard Holliman | Trevor Collins | Eric Jensen | Peter Taylor

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# 1

## Introduction

# 1. Introduction

ISOTOPE was an action research project (Jensen and Holliman, 2009; Somekh, 2006; Lewin, 1946) conducted at the Open University, UK. Led by Richard Holliman and Peter Taylor, this interdisciplinary project team was awarded £100,000 by the National Endowment for Science, Technology and the Arts (NESTA; Learning Award LP0286) to investigate the field (Bourdieu, 1977) of science engagement and to collaboratively develop a website that met the needs of practitioners. The project began in January 2007 and was funded by NESTA for 30 months. It involved several iterative phases of research (Holliman and Jensen, 2009; Jensen and Holliman, 2009; Holliman, Jensen and Taylor, 2007) and website development involving the project leaders, working with Eric Jensen and Trevor Collins, respectively, and a number of other contributors (see Section 3.1).

The website - [isotope.open.ac.uk](http://isotope.open.ac.uk)<sup>1</sup> - was launched in July 2009 with a range of seed content, some contributed by the project team, others by science engagement researchers and practitioners. We note that the site continues to be developed and administered by members of the project team, following additional funding from The Open University. Furthermore, additional content continues to be added by the project team and registered members of the website.

In this final report we reflect on the NESTA-funded phase of the ISOTOPE project, documenting: the wider context within which the project was conducted, alongside an overview of some of the core research findings (Section 1); the aims of the project (Section 2); the management of the project, noting how the key project milestones were achieved, including some of the problems encountered and lessons learned (Section 3); the various outputs from the project, including a description of the website and research papers (Section 4); the evaluation of the project deliverables, noting how the findings informed further website development (Section 5); the impacts of the project (Section 6); and, finally, a brief overview of the future plans for ISOTOPE (Section 7).

## 1.1 The emerging field of science engagement

The ISOTOPE project was conducted during a period of significant change in the relationships between sciences and their publics in the UK. Much has been written about governance of the sciences and related technologies in recent years (e.g., see Stilgoe, 2009; Holliman, Whitelegg, et al., 2009; Holliman, Thomas, et al., 2009; Stilgoe, et al., 2006; Jackson, et al., 2005; Wilsdon, et al., 2005; Irwin and Michael, 2003). Those arguing for change, such as these authors, have emphasised the desirability for greater ‘openness’ and ‘transparency’ in how the sciences are communicated among scientists and in the wider public sphere (e.g., see House of Lords Select Committee on Science and Technology, 2000), combined with calls for more sophisticated and coordinated communication and engagement strategies (e.g., see Nisbet and Scheufele, 2009; Holliman, 2008; Trench, 2008). Such developments have been complemented by a greater emphasis on the routine participation of citizens, other stakeholders

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1. A number of links have been included in this report. If you are reading the report online, selecting these links should take you to the relevant webpage.



and scientists in deliberations about how techno-scientific progress could and should be governed (e.g., see Stilgoe and Wilsdon, 2009; Leach, et al. 2005; Irwin and Wynne, 1996).

**Table 1: Characteristics of first-, second- and third order thinking (Irwin, 2008, p. 208)**

	First Order	Second Order	Third Order
<b>Main focus</b>	Public ignorance and technical education	Dialogue, engagement, transparency, building trust	Direction, quality and need for socio-technical change
<b>Key issues</b>	Communicating science, informing debate, getting the facts straight	Re-establishing public confidence, building consensus, encouraging debate, addressing uncertainty	Setting science and technology in wider cultural context, enhancing reflexivity and critical analysis
<b>Communication style</b>	One-way, top-down	Two-way, bottom-up	Multiple stakeholders, multiple frameworks
<b>Model of scientific governance</b>	Science-led, 'science' and 'politics' kept apart	Transparent, responsive to public opinion, accountable	Open to contested problem definitions, beyond government alone, addressing societal concerns and priorities
<b>Sociotechnical challenge</b>	Maintaining rationality, encouraging scientific progress and expert independence	Establishing broad societal consensus	Viewing heterogeneity, conditionality and disagreement as a societal resource
<b>Overall perspective</b>	Focusing on science	Focusing on communication and engagement	Focusing on scientific/ political cultures

In effect, pronouncements such as these require that a new 'social contract' be enacted between the (techno-) sciences and their publics (Gibbons, 1999) with a view to empowering, restoring or maintaining levels of democratic engagement among citizens with various areas of scientific and 'techno-scientific' endeavour (Irwin, 2009). Encapsulated under the term '(upstream) public engagement with science and technology' (Wilsdon and Willis, 2004) a social contract of this nature requires that all parties (natural scientists, social scientists, 'pro-ams', citizens and other stakeholders) revise and/or extend their routine practices of science communication to meet the requirements of a more demanding agenda (Holliman and Jensen, 2009). In effect, these calls require that practitioners of science engagement move beyond first order ('top down', deficit) thinking, to consider the relative merits of 'second order (dialogic, 'two-way') thinking and third order (contextual) thinking (as characterized by Irwin, 2008; see Table 1).

## 1.2 Shifting the rules of engagement

In recent years numerous calls for extending science engagement practices to include second- and third-order thinking have been communicated to UK scientists and other science engagement practitioners. These calls have been made through high-profile speeches, conferences, symposia (e.g., see Bultitude, *et al.*, 2009), and via a number of reports and pamphlets, e.g. from the House of Lords Select Committee on Science and Technology (2000), jointly from the Royal Society and Royal Academy of Engineering (2004), from the Parliamentary Office of Science and Technology (POST, 2006), from medical charities (Turney, 2006); and more recently from the Sciencewise Expert Resource Centre (2009; see also Stilgoe, 2009). A previous NESTA-funded project found that by 2007 these calls for increased science engagement had been met by “as many as 1,500 initiatives or programmes” (Mesure, 2007, p. 8).

Policy in this area has also been informed by consultations with various stakeholders and user communities. For example, the UK government recently conducted a consultation on science and society (DIUS, 2008), the results of which have informed the introduction of a number of expert working groups as part of an overall strategy coordinated by the Department of Business, Innovation and Skills (BIS; [interactive.bis.gov.uk/scienceandsociety/site/welcome](http://interactive.bis.gov.uk/scienceandsociety/site/welcome)).

Similarly, funding has been forthcoming over recent years for a range of engagement bodies to be constituted, including the introduction of the Sciencewise Expert Resource Centre (ERC; [sciencewise-erc.org.uk/](http://sciencewise-erc.org.uk/)), and a National Coordinating Centre for Public Engagement (NCCPE; [publicengagement.ac.uk](http://publicengagement.ac.uk)). The NCCPE coordinates the activities of a number of ‘beacons’ in the regions and component countries of the United Kingdom. This body is currently in the process of devising a ‘framework for public engagement’ across all academic subjects (not just the sciences, technology, engineering and mathematics), which in time will be supported by the publication of a number of ‘practitioner toolkits’.

## 1.3 Matching the rhetoric with the reality

Despite the rhetorical shift towards ‘dialogue’ and ‘engagement’ in UK science policy discourse, research evidence has questioned the degree to which natural scientists and science communicators have adopted the goals of the emerging ‘engagement’ agenda (e.g., see Davies, 2009; Burchell, 2007; Irwin, 2006; Wellcome Trust/MORI, 2001).

Findings such as these are complemented by the ones identified by the ISOTOPE team (Holliman and Jensen, 2009; Jensen and Holliman, 2009; Holliman, Jensen and Taylor, 2007). The ISOTOPE project team found the field of science engagement to be constituted by a disparate range of actors working in different sectors of the economy (including HEIs, industry, voluntary and charity organisations, non-governmental organizations and as full-time professional communicators). These actors had differing amounts of time to commit to science engagement activities, and varying levels of training and practical experience. The motivations and constraints that framed their science engagement work also varied, ranging from those that considered third stream activities to be their ‘duty’ (see also Royal Society, *et al.* 2006), to those who

worked as full-time professional science communicators. Our analysis revealed a mostly constricted set of engagement methods in the *past experience* of these research participants. Indeed, our findings are indicative of practical representations of engagement that have been defined by first order values and boundaries, as characterised by Irwin (2008). However, we also found that *current discourse* about public engagement amongst practitioners was more heterogeneous, suggesting that the overall field of science engagement is in a state of flux.

Large-scale studies of the field of science engagement like that conducted by the Wellcome Trust/MORI (2001) showed no evidence of second- or third-order thinking. Therefore, our finding of even a minority of practitioners defining public engagement in second-order (dialogic) terms is suggestive of a field that is changing or at least hybridising its self-conceptualisation (see also Burchell, *et al.* 2009). While this shift is certainly lagging behind the policy rhetoric, the level of change in less than a decade is significant. Drawing on Jensen and Wagoner's (2009) cyclical model of social change (Figure 1), we argue that the current state of the field is well into the T→I phase; this phase involves translating the new transcendent (T) representation of public engagement into an immanent (I) representation guiding practices.

The ISOTOPE project was conducted within this wider social and political context. It provided opportunities for natural scientists, social scientists, 'pro-ams', citizens and other stakeholders to share knowledge and experiences of science outreach and public engagement, whilst also reflecting on the emerging rules for science engagement. Working collaboratively with these stakeholders we produced the current (October 2009) version of the ISOTOPE website (Figure 2).

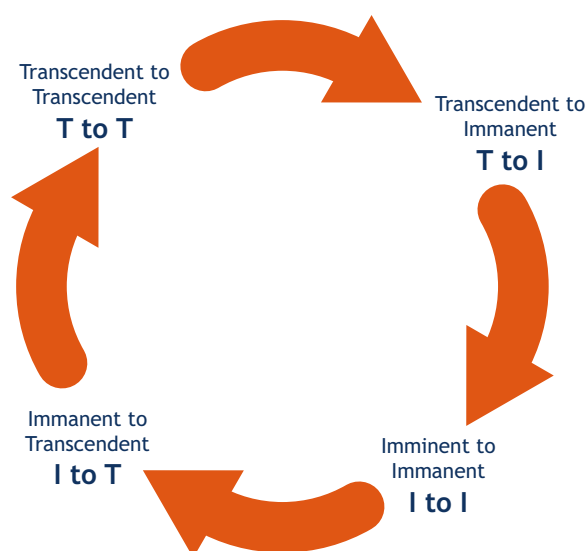


Figure 1: The four-phase cycle of change (Jensen and Wagoner, 2009, p. 218)

## 1.4 The ISOTOPE website

ISOTOPE is a website for those interested in engaging with the sciences (Figure 2; [isotope.open.ac.uk](http://isotope.open.ac.uk)). The site can be accessed through any web standards-compliant browser. Developing the site according to web standards means that it can be accessed from a range of computing devices, including some mobile phones. The site has also been designed to be accessible to those using end-user technologies, such as screen-reading software.



Figure 2: A screen grab of the ISOTOPE homepage; accessed October 2009

# 2

Achieving the aims  
of the NESTA-funded  
ISOTOPE Project

## 2. Achieving the aims of the NESTA-funded ISOTOPE Project

The ISOTOPE Project was funded to produce an open access, online portal of mixed media (print, audio downloads, streaming video, multimedia) resources, providing critically informed best practice advice, alongside practical suggestions. The online ISOTOPE portal was to be produced collaboratively working with expert consultants and relevant science engagement stakeholders.

The project was funded as an action research project. In researching the project we were required to address a number of research questions, including: ‘what motivates/constrains scientists and other stakeholders to engage with public audiences?’; ‘how, why, when and where do scientists and other stakeholders carry out public engagement?’; ‘how can a scientist or other stakeholder find out what an audience member already knows and/or believes?’; and ‘what knowledge and transferable skills might audience members find relevant and useful when engaging with the (techno-) sciences?’

The project team were required to collaboratively produce a series of four toolkits that provide practical activities and suggestions for conducting outreach, engagement, dialogue and deliberative exercises. Each toolkit was required to include case studies from experienced practitioners, ideas for innovative, discipline-specific activities, and guidelines for evaluation.

The outcomes of the ISOTOPE Project were to be used to influence policymakers and stakeholders in the emerging field of science engagement, and catalyse policy development at a national and international level.

### 2.1 Delivering the project aims

We argue that the core project aims have been delivered via the open access ISOTOPE website (Figure 2; [isotope.open.ac.uk](http://isotope.open.ac.uk)) and other project outputs (see Section 4 for further discussion). To find out what the site offers, select [How to use ISOTOPE](#) from the site’s homepage.

Furthermore, we argue that the project team has gone beyond what was required as detailed in the contract with NESTA, for example, by delivering additional resource areas on the website, as requested by practitioners during the various formative and summative research phases of the project (e.g. see the sections on [Training](#), [Further reading](#) and [Evaluation](#)). All areas of the site continue to have content added to them; if you want to receive details of these updates, please subscribe to the site’s [RSS feed](#).

At the time of writing (October 2009) the website has over 100 registered members and contains over 500 mixed media resources.

From July to September 2009 the website received an average of 45,000 hits a month. (These are the first three months that user data has been collected.)

## 2.2 Delivering the project aims via the ISOTOPE website

Specifically, the ISOTOPE project team has developed a flexible and extendable open access website, that is compliant with web standards, and that has been independently user tested. The site has been developed using modules and components of the Drupal open source content management system. The architecture of the site and the graphic design elements were developed by members of the Open University's Knowledge Media Institute (KMi), notably Trevor Collins and Peter Devine, respectively (see Figure 2).

The site currently (October 2009) displays over 500 entries, categorized under a number of themed sections (see Figure 2). The themed sections were requested by practitioners during the research phases of the project, including Events, Funding and Websites. Instructions are provided for each section of the site (e.g., Figure 3).



Figure 3: A screen grab of the Event instructions; accessed October 2009

### 2.2.1 Using ISOTOPE

Users and registered members have the option to search the whole site, parts of it, or to browse the resources. Anyone visiting the site also has the option to subscribe to updates via an [RSS feed](#). The site includes a news section that provides information on developments. The site also includes a ‘help’ (by email) link for users and members who experience problems with the site (Figure 4, Number 1).

The ISOTOPE website allows members to register their interests in science outreach and public engagement, thereby raising the profile of these practitioners and creating an online community. The [Members](#) database (Figure 4, Number 2), and its associated [Google map](#) (Figure 4, Number 3), serve to make this (increasingly international) community of practitioners more visible.

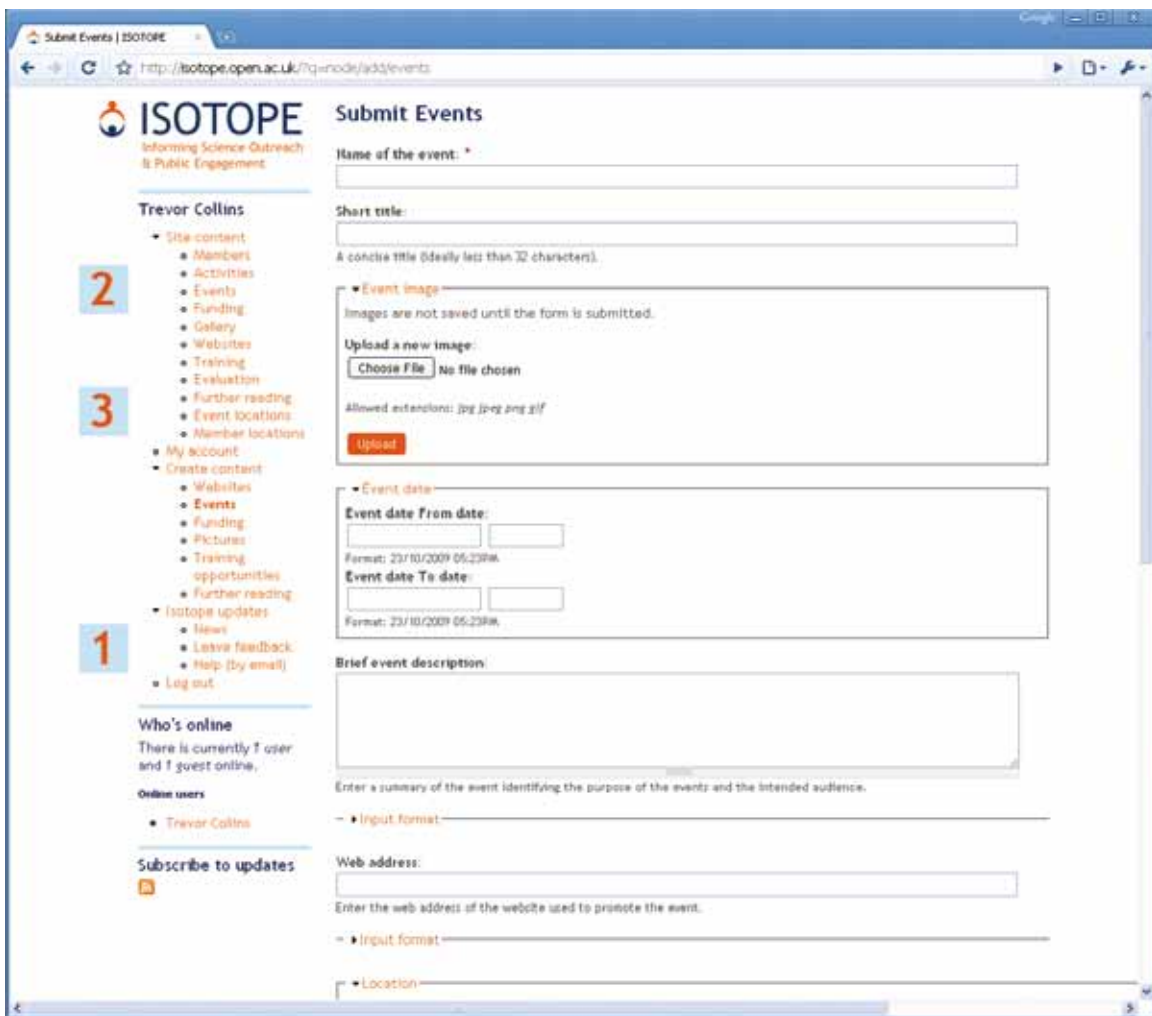


Figure 4: A screen grab of the form for submitting an Event to the ISOTOPE website; accessed October 2009, also illustrating some of the other available functionality (Numbers 1, 2 and 3)

Registered members can add content to various parts of the website, including forthcoming [Events](#), which can also be listed on a [Google map](#) (Figure 4, Numbers 2 and 3), [Funding](#), and so on. Instructions are provided for how to add content. To add content, members log in and complete



the online forms developed and trialed by the project team and members of the user community (e.g., see Figure 4). Such an approach allows members to ‘create and share’ resources.

All of the ISOTOPE resources that are currently (October 2009) on the site are licensed under a [Creative Commons Attribution-Non-Commercial-Share Alike 2.0 UK: England & Wales Licence](#).<sup>2</sup> (Links to resources held on external sites may have different licensing conditions.)

### 2.2.2 Activities

The website delivers a series of [Activity](#) toolkits (e.g., see Figure 5). These resources have been commissioned from experts working in the field of science outreach and public engagement. There are currently five completed toolkits published on the website. Several others are nearing completion and will be posted on the site in due course.

The screenshot shows the ISOTOPE website interface. The main content area is titled 'Café Scientifique' and includes the following sections:

- Submitted by:** Richard Holman on 3 September 2008 - 10:21pm.
- Short title:** Café Scientifique
- Author:** Anni Grand
- Author affiliation:** Assistant Organiser, Junior Café Scientifique (UK)
- Activity Description:** Science isn't just for wild-haired geeks in white coats, we all know that at some level - it's hard to imagine living our lives without the contributions of science and technology but many people never have routine opportunities to engage face-to-face with practising scientists. Combined with a flexible and adaptable structure that allows participants to organise events and engage directly with working scientists in ways that make sense to them, café scientifique can provide just such a forum for informal engagement with science.
- Member login:** A section with fields for Name and Password, and a Log in button. Below the button are links for 'Create new account' and 'Request new password'.
- Who's online:** A section stating 'There are currently 0 users and 1 guest online.'
- Subscribe to updates:** A section with a small icon.
- Planning and organisation:** A section with text describing the ideal venue for a café scientifique event, accompanied by an image of a café interior.

Figure 5: A screen grab of the Activity template produced by Ann Grand on developing, organizing and running a Café Scientifique (see also Grand, 2009); accessed October 2009

<sup>2</sup> Following recent feedback from the user community we are developing a more sophisticated policy with regard to the licensing of resources on the website, one that allows members to select the licence under which the resource they are uploading will be held. This revised licensing policy will be developed as part of the ongoing project funded by the Open University.

Furthermore, we have produced a template for the development of further activities (see [isotope.open.ac.uk/?q=node/43](http://isotope.open.ac.uk/?q=node/43)), to be suggested by practitioners of science outreach and public engagement. Members of ISOTOPE can suggest activities for inclusion on the website by emailing the project team, or completing the feedback form when they are signed in. The project team have worked (and continue to work) with the authors of activities to develop these resources; in effect, acting as editors and reviewers for these documents.

### 2.2.3 Training and Evaluation Resources

Following feedback in the summative research phase of the project the project team introduced a specific [Training](#) section on the website. Similarly, we introduced an [Evaluation](#) section. We are in the process of developing further resources to act as seed content for these sections of the website.

At the time of writing (October 2009) the website delivers a range of [Training](#) resources that address the related science communication and public engagement with science agendas, and which critically engage with some of the many and varied challenges facing natural scientists, social scientists, citizens and other stakeholders when they participate in these activities. This section of the site also lists current training opportunities in science communication and public engagement, both in terms of face-to-face events and distance learning opportunities, but also CPD training and taught courses.

### 2.2.4 Distributed expertise and the ISOTOPE community

The project team has made contributions to the respective theories and practices associated with: ‘science outreach’ and ‘public engagement’; ‘participatory design’; and ‘action research’. Such understandings have become apparent in our work with academics and practitioners who approach these issues with pre-existing knowledge, experience, attitudes, beliefs, assumptions and so on. In part working across disciplines has made these issues more visible as we have moved through the different phases of an iterative development cycle.

We have collaborated with a range of experts, including: producers of some of the resources; members of the site; and research participants. This includes: the academic staff of the Faculty of Science at the Open University (both centrally and nationally), the broader academic community, other relevant stakeholders and members of the public. These contributors have participated in the collaborative production (design, delivery and evaluation) of the ISOTOPE website, an online repository of critically informed practical advice for those interested in science outreach and public engagement. Please see the section of the site entitled [About ISOTOPE](#) for a list of contributors (or Section 3.1 of this report), the [Members](#) section for those registered as members of ISOTOPE, and the research reports for the sample of participants who were involved in the research phases of the project (see also Holliman and Jensen, 2009; Jensen and Holliman, 2009; Holliman, Jensen and Taylor, 2007; and Section 3.2.2, Tables 3 and 4).

The ambitious interdisciplinary agenda of the ISOTOPE project has required effective project management, with several streams of work running in parallel, involving experts from a range of backgrounds, both in terms of academic disciplines and practical experience of science outreach and public engagement. In this and other respects, notably the involvement of a range of stakeholders in the research phases and the production of resources, ISOTOPE was (and continues to be) a thoroughly interdisciplinary project. The ethos of the project can therefore be characterised as involving collaboration and different but complementary forms of expertise, and is therefore in keeping with the third order contextual approach to science engagement outlined by Irwin (2008). In practice, of course, this brings many benefits but also challenges. These issues are discussed in more detail in the following section.

# 3

## Managing the ISOTOPE Project

## 3. Managing the ISOTOPE Project

The management of the project is outlined in this section. The management of the ISOTOPE project required the completion of a number of milestones (Section 3.2), via a structure that enabled various stakeholders to make contributions (Section 3.1). As with any project of this nature the project team needed to overcome various challenges (Section 3.4), and to learn from these challenges (Section 3.5).

### 3.1 Project management

The management of the project involved principal investigators (Section 3.1.1), a management team (Section 3.1.2) and a steering group (Section 3.1.3). The ISOTOPE project team also contributed to a sharing group (Section 3.1.4).

#### 3.1.1 Principal investigators

The principal investigators for the ISOTOPE project were [Richard Holliman](#) and [Peter Taylor](#) of the Faculty of Science at the Open University, UK. Both have experience in managing large interdisciplinary projects, in terms of managing research projects (e.g. Carr, et al., 2009; Whitelegg, et al., 2008) and the production of mixed media distance learning materials for Open University courses (e.g., see Holliman and Yates, 2009; Holliman, Whitelegg, et al., 2009; Holliman, Thomas, et al., 2009; [isotope.open.ac.uk/SH804](http://isotope.open.ac.uk/SH804)).

The nature of the ISOTOPE project required the combination of a range of project management (in terms of managing the research and action elements to ensure that the findings of one phase informed the subsequent phases), dissemination, networking, budget management, and staff recruitment and development skills.

#### 3.1.2 The management team

The management team for the project included Richard Holliman and Peter Taylor working with [Eric Jensen](#), the project researcher, and [Trevor Collins](#), who developed the website. The interdisciplinary nature of this team - involving two social scientists, a physical scientist (inorganic chemist) and an educational technologist - has been crucial for the success of the project.

Members of the management team met regularly throughout the project, normally once a week. When face-to-face meetings were not possible, and sometimes when they were, the management team also kept in routine contact via email or telephone.

#### 3.1.3 The steering group

The steering group, chaired by Richard Holliman, had an advisory role on the project. This group was made up of Open University staff from different scientific backgrounds (physics, chemistry, life

sciences, Earth sciences and planetary sciences), all of whom had experience of science outreach and public engagement. The steering group included: [Hazel Rymer](#), [Jeff Thomas](#), [Vic Pearson](#), [Sam Smidt](#), [James Bruce](#), and an expert in the design and evaluation of digital technologies, [Eileen Scanlon](#).

The steering group made a number of contributions to the project, including: trialing and providing feedback on various areas of the website; authoring content for the website; suggesting resources; commenting on drafts of research publications, and advising on dissemination strategies.

#### 3.1.4 The sharing group

The ISOTOPE Project was complemented by a further NESTA-funded project named Science Engagement and Researching Change (SEARCH; [bristol.ac.uk/cms/cpe/search](http://bristol.ac.uk/cms/cpe/search)). This project was run at the Centre for Public Engagement (previously the Institute of Advanced Studies) at the University of Bristol. The project was led by Kathy Sykes, working with Gillian Squirrel.

Patrick Tissington from Aston University was responsible for liaising between the project teams on behalf of NESTA. He organized the sharing group meetings, in liaison with Nigel Eady from the Science and Society team at the [British Science Association](http://britishscienceassociation.org) who monitored progress on the ISOTOPE project on behalf of NESTA ([britishscienceassociation.org/web/ScienceinSociety/NESTA/Learning\\_Awards.htm](http://britishscienceassociation.org/web/ScienceinSociety/NESTA/Learning_Awards.htm)).

The sharing group met at various points during the lifetime of the two projects, mainly to exchange findings from the respective teams and report on progress.

#### 3.1.5 Other contributors to the project

There are a number of other contributors to the ISOTOPE project, some of whom are named below. However, following the procedures outlined to them during the recruitment phases for the research elements of the project, the research participants remain anonymous. Nevertheless, we acknowledge the important contributions of those who participated in the research phases.

Others have contributed to the development of this site, and they are listed below.

##### *Graphic design and editing*

[Kim Porter](#) designed the original version of the ISOTOPE logo. [Peter Devine](#) at the Open University worked as the graphic designer for the revised version of the website and the associated promotional materials (in consultation with Trevor Collins and Richard Holliman).

[Pat Forster](#) worked as a consultant editor on the prototype version of the website, in particular providing comments on the content and structure of the instructions for the website, while members of the ISOTOPE project team edited the academic content.

### Independent user testing

Samantha Lee was commissioned to conduct independent user testing of the prototype website.

## 3.2 Fulfilling the project milestones

The project team were required to complete ten ‘milestones’, as detailed in the contract between NESTA and the Open University (Figure 6).

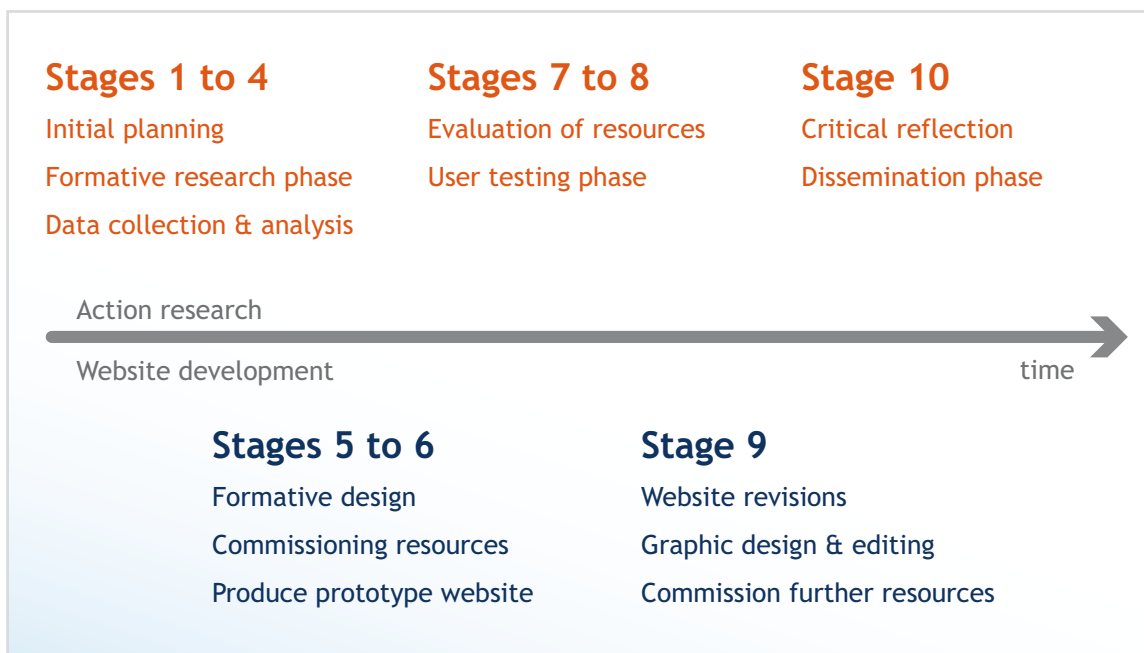


Figure 6: Illustrating the ISOTOPE project milestones and the combination of action research and website development

### 3.2.1 Stages 1 to 2 - Initial planning and administration

Initially the project involved various administrative requirements, not least the recruitment and selection of the project researcher. These tasks were completed without any major problems, but the original start date of the project was slightly delayed as a result.

Two initial sharing group meetings were held towards the start of the project, both at Aston University. They were facilitated by Patrick Tissington and members of his team. The two co-PIs attended along with the project researcher (who was not formally in post at the time).

### 3.2.2 Stages 3 and 4 - Formative planning, research and analytical phases

Table 2 documents the structure of the formative focus groups; Table 3 lists the final focus group sample; whilst Table 4 documents the sample for the complete initial data collection phase.

**Table 2: Illustrating the structure of the formative focus group interviews**

Stage	Task
1	Initial briefing - Moderator-led This was the initial briefing when the focus group convened.
2	Story board activity - Participant-led The focus groups included a 'focused activity', which served as a stimulus to foster participant-led dialogue and interaction.
3	Presentation of story board - Participant-led Participants presented their storyboard to the moderator, describing the target audience(s), content, aims and objectives, structure of the event, and evaluation strategy.
4	General discussion - Moderator-led Based on a semi-structured question guide, the general discussion examined decisions made in Stages 2 and 3, and general questions about participants' experiences with science engagement, and their motivations and constraints in participating in this field.
5	Final questionnaire - Completed as individuals Participants completed a final questionnaire listing issues that they felt had been missed, and reflected on their experiences of participating in the study.
6	Final debriefing - Moderator-led The moderator invited questions from participants.

The formative planning, research and analytical phases were completed in this part of the project. This began with a standard review of the primary research literature, which was extended to include secondary and grey literature, providing evidence of practical advice and guidance, access to various pamphlets and official documentation (see Holliman, Jensen and Taylor, 2007).

The project team also developed a strategy for the formative research phase, including data collection of self-report activity summaries, an online questionnaire, and a series of eight focus group interviews (see Jensen and Holliman, 2009 for discussion, and Tables 2 and 3). Relevant equipment for the research phases was also purchased at this stage, including a data recorder and licences for ATLAS-ti (a qualitative data analysis software application).



**Table 3: Sample for the formative focus group study, documenting the description of participants, gender distribution, date of focus group, its location and the group product**

ID	Description of participants	Gender distribution	Date of focus group	Place	Focused activity: The group product
1	Postgraduate research scientists	3 females 4 males	11/04/07	London	School-based lecture demonstration
2	Experienced scientists	1 female 4 males	24/04/07	Milton Keynes	School visit linked to National Science and Engineering Week
3	Early career scientists	1 female 2 males	08/05/07	Cambridge	Megalab
4	Open University Science Staff Tutors	7 females 4 males	10/05/07	Devon	Café Scientifique
5	Open University Science Staff Tutors	7 females 4 males	10/05/07	Devon	Megalab
6	Science teachers	3 females 3 males	15/06/07	Cambridge	Café Scientifique
7	Professional science communicators	6 females 1 male	16/06/07	London	Online science news magazine
8	Mixed group	3 females 1 male	05/07/07	London	Lecture demonstration

During this stage we also produced an initial project website, and secured the project URI (Uniform Resource Identifier; [isotope.open.ac.uk](http://isotope.open.ac.uk)) and the project email address ([science-engagement@open.ac.uk](mailto:science-engagement@open.ac.uk)). We note that the initial project website has been replaced with the current version. We also produced materials for the NESTA website. These materials were removed shortly after NESTA's Learning Programme was ended, but were revised for inclusion on the website of the [British Science Association](http://www.britishsociety.org) once they took on the project management role on behalf on NESTA.

**Table 4: Sample distribution for the three elements of data collection in the formative research phase**

Description of participants	Activity summary	Questionnaire	Focus group
Postgraduate research students	10	8	7
Early career scientists	9	7	4
Experienced scientists	9	6	5
OU Science Staff Tutors	-	5	22
Science Teachers	7	6	7
Professional Science Communicators	23	11	8
'Pro-am'	1	1	1
<b>Total</b>	<b>59</b>	<b>44</b>	<b>54</b>

### 3.2.3 Stages 5 and 6 - Findings from the research and formative design phases

The findings from the formative research phase were reported to NESTA in the interim report (Holliman, Jensen and Taylor, 2007; see also Holliman and Jensen, 2009). The study illustrated a mixed picture in terms of the research participants' knowledge and experiences of science outreach and public engagement (SCOPE). Whilst participants arrived at the focus groups with some knowledge and experience of SCOPE, in many cases this was characterised by a much clearer understanding of first order thinking (deficit) when compared to second (dialogue) and third order (contextual) equivalents (see Table 1 of this report and Irwin 2008 for discussion of first, second and third order thinking). This finding was also supported by the data analysed from the focus group interviews.

At this stage in the project we recruited Trevor Collins from KMi, an expert with an established reputation for the design of educational technology (see Section 4.1.2 for a discussion of Collins' previous work). Collins developed the prototype for the website, in collaboration with the project team, using modules and components from the Drupal open content management system (Figure 7).

Running in parallel to the development of the website, the project team also commissioned the production of various resources to act as 'seed content' for the site. This included a number of activity templates, including those produced by:

1. Ann Grand, on how to run a Café Scientifique (Figure 5); [isotope.open.ac.uk/?q=node/81](http://isotope.open.ac.uk/?q=node/81)
2. Robert Lambourne, on planning and delivering public lectures about science; [isotope.open.ac.uk/?q=node/4](http://isotope.open.ac.uk/?q=node/4)
3. Douglas Walker, on how to raise quail from eggs; [isotope.open.ac.uk/?q=node/5](http://isotope.open.ac.uk/?q=node/5)

4. Norbert Steinhaus, on the principles of running a science shop; [isotope.open.ac.uk/?q=node/35](https://isotope.open.ac.uk/?q=node/35)
5. Eric Jensen, on using focus group interviews as a method for engaging publics about specific issues; [isotope.open.ac.uk/?q=node/48](https://isotope.open.ac.uk/?q=node/48)

Other seed content was also produced and/or uploaded by the ISOTOPE project team, whilst further activity templates are in various stages of development.

Once a prototype version of the website was in place (Figure 7), and some seed content added, we introduced a membership database. This membership database was further developed from earlier work conducted prior to the NESTA-funded phase of the project, drawing on the experiences of the Netscope Initiative ([open.ac.uk/science/outreach/netscope.php](https://open.ac.uk/science/outreach/netscope.php)) and a membership database that had been produced for a research group at the Open University. Further findings from the formative research phases were also listed in the interim report (Holliman, Jensen and Taylor, 2007; see also Jensen and Holliman, 2008; Jensen, et al. 2007; Holliman, 2007), most of which informed the development of the website, and the associated content (see Table 5 and Figure 7).

We note that subsequently we realised that some of the entries in the six sections of the prototype site did not work under these categories. Number 3 in Figure 7 illustrates this, with the British Science Association Media Fellowships listed under the Funding section. It was therefore agreed that additional sections of the site would need to be added. These included Training (both ‘training opportunities’ and ‘training resources’), Evaluation, and a Gallery of images (see Section 3.2.6 and Figure 8, Numbers 1, 2 and 3).

**Table 5: Illustrating participant suggestions from the formative research and how these suggestions informed the system features on the prototype website (see Figure 7, Numbers 1, 2, 3 and 4)**

Request for website	Group ID	System feature
Explanation of range of activities - practical hints and tips	1, 2, 3, 4, 5, 6, 7, 8	‘Activities’ - see Number 1 in Figure 7
Centralised national online database of practitioners	1, 2, 3, 5, 6, 7	‘Members’ - see Number 2 in Figure 7
Links to organisations or institutions that will fund activities and events	1, 4, 5, 7, 8	‘Funding’ - see Number 3 in Figure 7
National Curriculum advice - links with science teachers/schools	2, 3, 6	Where relevant these links are included in the activity templates.
Information on local events and activities	1, 4, 7	‘Events’ - see Number 4 in Figure 7 (see also Figures 4 and 9)

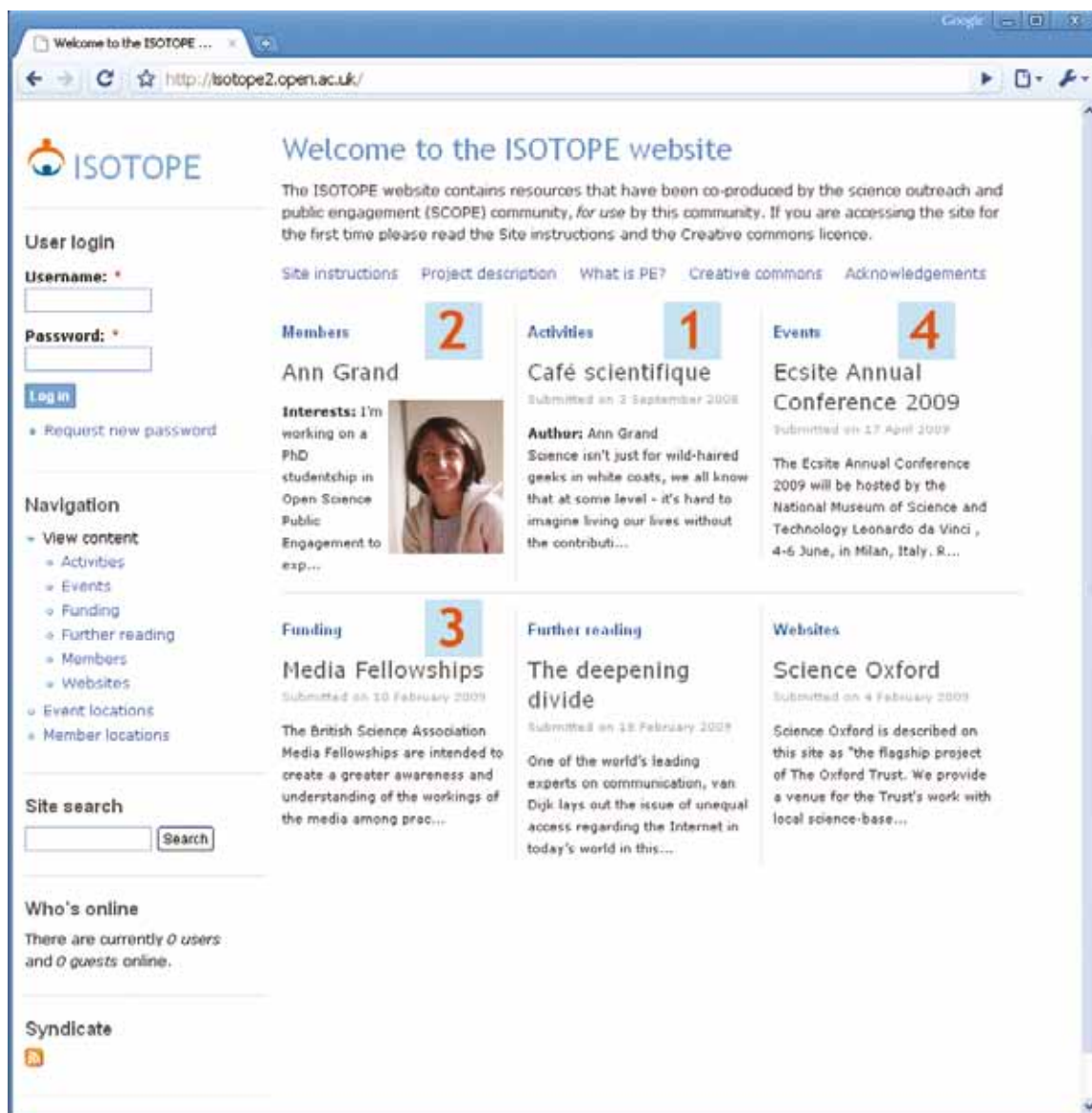


Figure 7: A screen grab of the prototype ISOTOPE homepage; accessed October 2009 - see Table 5 for how the prototype site was informed by the formative research findings as shown at Numbers 1, 2, 3 and 4

### 3.2.4 Stage 7 - Audiences recruited for full-scale trials of toolkits

The ISOTOPE team agreed on the basis of the findings from the initial focus group study to produce six main areas of the website: activities, members, events, funding, further reading and websites (Figure 7). We commissioned a number of authors to produce activity templates for the website following a template; several of these were added to the prototype site. The project team been populated the other areas of the site, prior to the planned 'soft launch'.

Three practitioner toolkit authors agreed to participate in trialling of their toolkits with public audiences. These trials were evaluated, comprising full-scale trials of the ISOTOPE science outreach and public engagement activities (see Section 3.2.5).

Furthermore, in order to provide a pilot example template that had been subjected to multiple levels of in-depth evaluation, we undertook a case study of a series of dialogue-based public engagement events that used an ISOTOPE template authored by a science outreach officer at the Open University. The template was deployed in eight different locations around the UK (including Wales, Scotland and Northern Ireland). These public engagement activities were delivered by a science outreach officer, with the help of outside consultants employed to provide advice and an independent evaluation of the project, called [Listen to me, I'm a patient](#). The project researcher conducted interviews with the organizer and facilitators for the events to identify their goals and expectations, both before and after the events took place. Audience questionnaires, one-to-one interviews and focus groups were conducted to assess the level of correspondence with practitioners' expectations, goals and understandings of audience characteristics.

### 3.2.5 Stage 8 - Findings from User Testing and Participant Observation

Outline findings from this user testing and participant observation are included below. Several iterations of the prototype website were made on the basis of the user testing, including a re-design of the homepage and search facilities, the introduction of three new sections to the site (Training, Evaluation and the Gallery), revisions to the site instructions, and the introduction of Google maps for members and events (see Section 3.2.6).

#### *User Testing - Summary of results*

We commissioned a user testing phase, providing comprehensive testing of the website functionality and assurance from the user community of its fitness for purpose. A customised user testing methodology was derived for use throughout this phase to accommodate the conventional testing of website functionality in conjunction with atypical testing of hermeneutic dimensions, including user feedback on site instructions and website content.

Five user testers were engaged during the user testing phase to assess a total of five distinct test scenarios. These user testers were recruited from a range of engagement practitioner communities, reflecting the end user population for the ISOTOPE website. Each user tester completed two scenarios. This allowed each test condition to be covered by a minimum of two user testers to assure the quality of the website's functionality. The user test scenarios reflected naturalistic user navigation flows across the ISOTOPE website, derived from grounded analysis of formative focus group transcripts, as well as consideration of functional clusters on the prototype website itself. A total of 864 test steps were executed in the user test phase, yielding a composite pass rate of 98% for the functional user test conditions.

Quantitative measures of the efficacy of hermeneutic dimensions of the website content evinced positive user perceptions about the clarity, intelligibility and utility of the information provided. User testers were given Likert scales to indicate their agreement with positive statements about the effectiveness of various textual elements on the website. 79% of such ratings registered positive ratings of this content, 16% neutral, and 5% negative.

The full ISOTOPE user testing report provides more complete quantitative information as well as the results from the qualitative components of the user testing questionnaire.

### *Participant Observation - Summary of results*

Full-scale trialling of the toolkit activities involved participant observation research. Indicative summary findings for one of these toolkit trials are presented below.

The first case study examined two iterations of a dialogue-based public engagement template using film clips as a stimulus for group discussions about the future of robotics. A pre-event focus group with practitioners, participant observation of both 1.5 hour sessions and follow-up questionnaires distributed to audience members were used to identify the level of correspondence between practitioner goals and audience response patterns. Second, in order to assess the motivations and perceptions of both practitioners and publics participating in science outreach (didactic/one-way) activities, we conducted a day-long participant observation of one section of a science festival devoted to biology. In addition, interviews with practitioners and audience questionnaires were used to collect further data about participation in this form of science communication activity to inform the template being authored by the primary organizer of this event.

Although the advertising for this event promised to deliver the ‘facts’ regarding a topic about which science fiction had ‘whipped up’ public concern, the actual event was not didactic. It was largely a second order (dialogic) event in practice, aimed at allowing members of the public to discuss the social, ethical and legal implications of robotics in a facilitated group setting. The stimuli for this discussion were film clips featuring advanced humanoid robots and open-ended discussion questions.

Overall, the event was successful in fostering a discussion about robotics amongst members of the public, which was the aim defined in advance by the practitioner team. Given that the event organisers included some rather edgy discussion questions (e.g. the potential future danger of paedophiles having ‘child sex’ with robots), the dialogues that emerged allowed participants to effectively discuss the issues.

### *Summative Focus Groups held with practitioners*

The sample for the summative focus groups deliberately drew on previous research participants from earlier phases of the ISOTOPE project, to see how their opinions had changed over the life of the project. This presented some difficulties in terms of recruitment. As a result, only two focus groups were completed in the summative phase. The focus groups were held in London and Milton Keynes.

Prior to the focus group, participants visited the ISOTOPE website and completed a short evaluation questionnaire. This procedure ensured that all focus group participants had experienced the website at a minimum level, providing the basis for critical discussion about its efficacy. During the focus

groups participants were given a tip sheet that invited them to design an equivalent website to ISOTOPE. This was followed by a group discussion where participants discussed their views on the prototype version of the site.

On this basis, participants provided a great deal of specific feedback and recommendations related to the website.

1. The research participants recommended softening the relatively formal academic tone of the website ‘welcome’ and instructions. In addition, a highly inclusive definition of the site’s potential users and ‘engagement practitioners’ should be provided on the Homepage so that users know the site is for them. (e.g. ‘This site has been developed for anyone with an interest in talking to any public about any aspect of science, technology, mathematics or medicine.’)
2. The research participants recommended providing very basic, high-level summaries on each instruction or information page, and then allowing users to click for further information should they desire it.
3. The research participants recommended providing a clear direction for new users of the site in terms of which content they should view first (if they don’t have clear aims in mind already). Later, it emerged that the Activities and Members pages would be the best choices for such a first direction, given they were the most unique and interesting to most practitioners.
4. The research participants requested more imagery for the site to make it more aesthetically pleasing and ‘attractive’.
5. The content of the site was described as unique and the activity templates in particular were singled out as ‘very useful’.
6. A request was made for an organising scheme for activity templates. Two axes recommended for such a scheme were ‘interactivity’ and ‘audience size’. It was suggested a practitioner could adjust a sliding scale on both these dimensions to receive recommended activities from the website.
7. Participants were particularly pleased with the pictures attached to Members. They said this made for a degree of human interest that was quite appealing. (Subsequently when members register we encourage them to upload a picture for the benefit of the website.)
8. There was a suggestion that it would be useful to have a ‘what’s changed/new’ summary come up for participants when they return to the website (akin to Facebook’s). This linked in to the importance of the website being perceived as ‘fresh’ and updated with new content regularly. (In addressing this issue we have further highlighted the functionality of the RSS feeds, and added a News section to the site.)

9. There were also some quite technical issues, including the need for the search bar to follow users down the page when they scroll down and the need for a 'Return to top' link on pages as well as an easy 'Return to previous page' link. (We have added further links to address these issues.)
10. Participants liked the randomised selection of members to be displayed on the front page and they advocated this being extended to the other pages which have a selection previewed on the home page (rather than the reverse chronological order currently in place). Again, the aim here is to evince 'freshness' and 'newness'. (We have introduced this for the Activities section.)

Overall, there was a clear statement from participants that the ISOTOPE website delivers very useful content, that they would want to be members of this website and that the changes required were primarily in form, phrasing and aesthetic appeal.

### 3.2.6 Stage 9 - Revising the website

We made a number of revisions to the website on the basis of the findings from the user testing and summative focus groups, not least introducing three new sections. These new sections, called 'Gallery', 'Training' and 'Evaluation', respectively, are numbered 1, 2, and 3 in Figure 8. We also employed a graphic designer to make the website more visually appealing (compare Figures 7 and 8). Furthermore, we employed a professional web editor who helped to simplify the structure and content of the instructions for the site. Finally, we revised the Welcome message for the website and introduced further links to the Search page. These changes are numbered 4 in Figure 8.

Figure 8 (Number 5) also illustrates some of the additional functionality available to registered members, not least the ability to 'Create content' and to leave feedback for the project team.

Following these revisions we made presentations at several events with potential user communities (e.g. Holliman, et al. 2009; Jensen and Holliman, 2009; Holliman and Thomas, 2009). We continue to disseminate information about the site.





Figure 8: A screen grab of the ISOTOPE homepage with two registered members logged in; accessed October 2009, illustrating revisions to the site - Numbers 1, 2, 3, 4 and 5

### 3.2.7 Stage 10 - Approval by NESTA of the final report and accounts

This document is the final report for NESTA, to be submitted to the British Science Association who has administered the project on behalf of NESTA. This submission includes a financial report from the project, which has been submitted separately.

## 3.3 Explanations of changes of direction that took place

In adopting an action research approach in the ISOTOPE project we assumed a priori that we would adapt the aims and objectives of the website to meet the needs of the user community. In completing the research and dissemination phases it became apparent the field of science engagement is one characterised by a wide range of needs, with sometimes disparate aims and objectives, and different communities of stakeholders (some academic, some professional, some voluntary, and so on). Over-provision of resources was considered to be the most appropriate way of

addressing this diversity. Having said this, no significant changes of direction took place in relation to the original contract agreed with NESTA.

We also note that we renegotiated the start date for the key dates and milestones, as the recruitment and selection of the project researcher took longer than planned. The end date of the contract was also extended by seven months to the end of July 2009, allowing the project team time to revise the website following the user testing and summative research phases, and to disseminate details of the project to various user communities.

### 3.4 Problems encountered

The project did not encounter any major problems in achieving the aims as laid out in the contract with NESTA. However, there are wider contextual issues that the project encountered that did influence our work. For example, there continue to be challenging and unresolved issues within the emerging field of science engagement, notably what this term might mean to the various stakeholders who routinely use it (see Section 1). The overall field of science engagement has disparate and sometimes conflicting aims and objectives, levels of training and experience, etcetera, with no overarching body to assess standards or provide benchmarking statements. In a similar vein, while a number of CPD training and formal taught courses have been developed by a number of providers, this provision has yet to be fully integrated within undergraduate and postgraduate training programmes for scientists, technologists, engineers and mathematicians, and the enthusiasm for reflective practice informed by evaluation studies varies among science engagement practitioners.

In effect, over the lifetime of the NESTA-funded ISOTOPE project (January 2007-July 2009) the field of science engagement existed within a ‘mixed economy’ of first-, second- and third-order practices, sometimes overlaid by normative judgements about the relative merits of these approaches. In addressing this diversity we decided to produce a website following a resource-based approach, with a deliberate over-provision of resources. As such, we decided not to impose an ‘ISOTOPE’ perspective on the website, also allowing members to upload content that they found relevant and valuable. Of course, we acknowledge therefore, that the ISOTOPE site is also contributing to the mixed economy and ambiguity of what the term public engagement could and should mean.

We also note, as others have (e.g. Duncan and Upton, 2009), that the overall marketplace for websites that address aspects of science outreach and public engagement has proliferated in recent years. This is not necessarily a problem in and of itself; each has a remit, purpose and target community. But there are several issues worth noting in relation to this over-provision, including:

- A general lack of communication during the lifetime of the NESTA-funded ISOTOPE project between institutions developing websites, and those developing the sites themselves. This lack of communication means that sites are being developed from scratch, including ISOTOPE, without the opportunity to share ideas, experiences, and so on.

- The continued development of sites in isolation from each other means that this reduces the chances for them to be compatible and/or inter-operable (Holliman, 2010, in press). In part, this appears to be due to the desire to retain institutional, ideological, technological or administrative control over the content (sometimes also the structure, membership and access to resources) of these sites, and therefore also what does and does not count as public engagement, as defined by these bodies. This severely limits the opportunities to share content and resources between sites.
- Issues of security continue to be a problem for all websites that allow users to upload content. The ISOTOPE project team revised the registration procedures to address a series of attempts to register members who clearly were not interested in uploading content relevant to science engagement. This issue is an ongoing concern and one that we will continue to monitor. We will revise how we administer the site to meet these demands.

### 3.5 Learning points

In collaboratively producing the ISOTOPE website within an interdisciplinary team we started from perspectives informed by our respective home disciplines. Such an approach has benefits and drawbacks as theoretical positions and concepts are made visible to others. Within these discussions the project team had to consider the process of developing the website and the subsequent content and structure as separate but obviously related elements that inform each other. Developing the website following an effective participatory design approach allowed us to address the current diversity in thinking about public engagement, whilst also ensuring that practitioners had some involvement in informing the content and structure. Making this process visible on the website and through research publications and reports helped to validate this process in a more open and transparent way.

It follows that we started the project with a set of assumptions and ideas that informed the initial phases of action research. However, we did not know what was required of the site until we had engaged with the practitioners who we wanted to use it. Similarly we have noted that the field of science outreach and public engagement is a diverse one. This required that we engaged with a wide range of potential users of the site, whilst also over-providing in the subsequent content and structure to meet the diverse needs of these different practitioners. As a result, the ISOTOPE website includes resources that illustrate examples of first-, second- and third-order thinking (Irwin, 2008). This type of approach does take time and not everyone working in the field of science engagement may agree that it is the most effective use of resources. It is also a work in progress. As the site is used we will continue to adapt and revise it to meet the needs of members and users.

We acknowledge some of the challenges of sharing the results of the project within such a diverse field. Indeed, our work is also ongoing in this respect. This has required different strategies and different emphases of presentation. Our experiences of these processes indicate that, in general, academic communities have responded positively to process accounts that have emphasised the

research-informed approach to the development of the website. In contrast, professional science communicators have been more interested in the outcome informed approach we adopted in developing the website and how this could affect them: ‘why should I join?; ‘what can this website do for me and/or professional science communicators?’; ‘is the site sustainable?’; and so on. These different emphases reflect the interests and objectives of these communities and their members. As academics working in this field, we are still learning about the needs of other (mainly practitioner) stakeholders.

# 4

Outputs from the  
NESTA-funded  
ISOTOPE Project

## 4. Outputs from the NESTA-funded ISOTOPE project

The main outputs from the project have been the website ([isotope.open.ac.uk](http://isotope.open.ac.uk)), and various forms of dissemination in relation to the research phases of the project and in launching the site. These are listed in the following sub-sections.

### 4.1 Online resources

The website can be found at: [isotope.open.ac.uk](http://isotope.open.ac.uk). The outputs for the website include the architecture of this site, graphic design elements and introduction of a range of ‘seed’ content. Some of the seed content has been entered by the project team, other resources by registered members of the website.

At the time of writing (October 2009) the website has over 100 registered members and contains over 500 mixed media resources. From July to September 2009 the website received an average of 45,000 hits a month. (These are the first three months that user data has been collected.)

#### 4.1.1 Using the ISOTOPE website

The ISOTOPE website is open to visitors who want to search or browse the resources. To submit resources to the site, users must first register as a member (or user) of ISOTOPE. Instructions for how to register are included on the website. Members of the project team validate the requested accounts to ensure that genuine members have access to the site. Those who upload resources to the website currently (2009) do so under the conditions of a [Creative Commons Attribution-Non-Commercial-Share Alike 2.0 UK: England & Wales License](#); but see also the comments in Section 2.2.1, Footnote 2.

#### *Searching the ISOTOPE website*

Users can search the site from the [Search page](#), which includes an option for advanced searches. The advanced search function allows users to search the whole site or certain sections of the site. For example, they might want to search only the ‘Events’ section of the website. Users can also filter searches by member interests (which searches the membership database) or users (if they are looking for a specific individual) by using the tabs on the Search page.

#### *Using the Google maps*

We have included Google maps to illustrate [Event locations](#) and [Member locations](#). Users simply have to select one of these links and hover their cursor over a marker for further information; clicking on a marker displays an overview of that entry.

## Subscribing to updates

Visitors and members have the option to [subscribe to updates](#). In subscribing to the ISOTOPE RSS feed, users automatically receive the most recent content added to the site direct to the application of their choice.

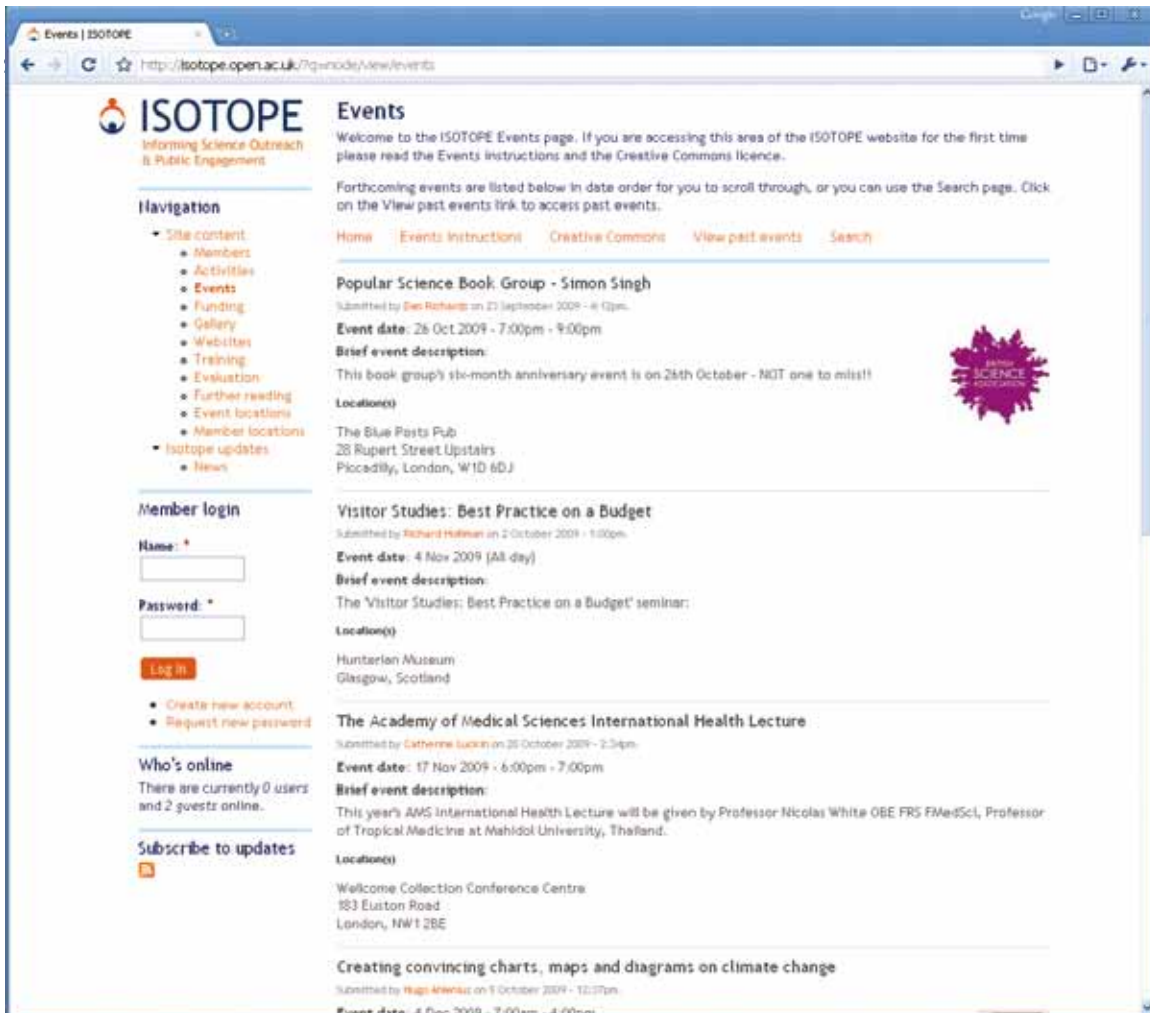


Figure 9: Showing the Events page; accessed October 2009

## Using the ISOTOPE resources

In each section users can scroll down to browse the resources (e.g., Figure 9), or look for something specific by using the Search function. The resources in each section have been submitted by the project team or by ISOTOPE members under a Creative Commons licence.

- **Members:** A list of current ISOTOPE members and their interests. Registered members can update their profile at any time when they are logged in.

- **Activities:** Descriptive accounts of science outreach and public engagement activities. These activities have been commissioned by the project team. The project team has also developed a template for further activities to be added to the site. Future contributions to this section will be assessed by the project team before going live on the site.
- **Events:** Short summaries of upcoming science communication and public engagement events (users can also access an archive of previous events). Registered members can add entries in this section when they are logged in.
- **Funding:** Short summaries of funding opportunities in science communication and public engagement. Registered members can add entries in this section when they are logged in.
- **Gallery:** Images from previous science outreach and public engagement projects and activities that are available for re-use. Registered members can add entries in this section when they are logged in.
- **Websites:** Short summaries of websites that address the related fields of science communication and public engagement. Registered members can add entries in this section when they are logged in.
- **Training:** Descriptions of training opportunities and a list of training resources for science outreach and public engagement practitioners. Registered members can add training opportunities in this section when they are logged in. The project team will assess training resources before they are added to the site.
- **Evaluation:** A number of evaluation resources, including those produced by the ISOTOPE team, and lists published reports and resources that are available online. The project team will assess evaluation resources before they are added to the site.
- **Further reading:** Short summaries, reviews and links to publications relevant to science outreach and public engagement practitioners. Registered members can add entries in this section when they are logged in.

The ISOTOPE logo and name is a constant at the top left-hand corner of the page. When selected this takes users back to the Home page. Similarly, the navigation panel in the left-hand menu remains a constant on each page impression.

### *ISOTOPE Membership*

To register, a prospective member has to be select [Create new account](#) and complete the registration form (Figure 10). Prospective members need to provide a valid email account so that an administrator can validate their account and contact them with an initial password. When this initial password is provided, new members are asked to change it when they initially log in.

Whenever a member logs in they have the option to edit their profile or change their password. Once a member logs in they are provided with additional instructions on how to add or revise the resources they submit. (Members can only revise content that they have added.)



Figure 10: Showing the registration form; accessed October 2009

Before registering, prospective members are informed that they are also agreeing to the project team contacting them about science outreach and public engagement issues, and that the team will only do this to inform them of future ISOTOPE-related events, and so on. Prospective members are also informed that their details will remain confidential and will not be passed on to any third party. The only contact details that appear on a member's profile are the ones that they select to appear. To reduce the levels of spam none of the member's email addresses appear on the website.

Registered members are informed that they can ask for their membership to be cancelled at any time by contacting the ISOTOPE team ([science-engagement@open.ac.uk](mailto:science-engagement@open.ac.uk)). Users of the site are also advised that they can send any comments or suggestions they have on the site to the project team ([science-engagement@open.ac.uk](mailto:science-engagement@open.ac.uk)). Members can email feedback to the team or submit comments and suggestions when they are logged in, via the online feedback form.

### 4.1.2 The website infrastructure

The ISOTOPE website illustrates the use of social software tools to help engage and inform community members. The website was developed by [Trevor Collins](#), building on his work in community informatics research undertaken at the Knowledge Media Institute (KMi) at the Open University. Trevor Collins brought extensive experience to the ISOTOPE team in the design and development of community centered portals for supporting learning and professional development in museum, school and university contexts (see Collins, Mulholland, and Zdrahal, 2009; Collins, et al., 2008; and Whitelaw and Collins, 2009). Furthermore, Richard Holliman and Trevor Collins previously collaborated to develop the [Netscope](#) online community directory for OU science outreach and engagement practitioners.

The infrastructure of the ISOTOPE website was developed using [Drupal](#), an open source content management system (Figure 11). Drupal has been developed over the last ten years from a project initiated by Dries Buytaert in 1998/1999. First released as an open source project in 2001, the [drupal.org](#) developer community currently (2009) includes over 350,000 subscribed members.



Figure 11: The homepage of the Drupal open source community; [drupal.org](#) accessed October 2009

### 4.1.3 The seed content

The introduction of content to the website is an ongoing process. At the time of writing (October 2009) there are over 500 resources listed on the website as ‘seed content’ in the eight sections (activities, events, funding, gallery, websites, training, evaluation and further reading) and over 100 registered members. The seed content has been added by members of ISOTOPE and the project team. In addition, we commissioned several consultants to produce activity templates. (The process of recruiting additional members and adding content to the site is ongoing.)

### 4.1.4 The graphic design elements

Kim Porter designed the first version of the ISOTOPE logo, in collaboration with the principal investigators. The graphic design elements for the prototype website were designed by Trevor Collins from KMi at the Open University in consultation with the project team. Peter Devine, also from the Open University, worked on the redevelopment of the graphic design elements, taking on board comments from the user testing phase, the second focus group study, and comments and suggestions from the management team. Peter also produced the designs for the project postcards, business cards, t-shirts, stickers, posters and this report in consultation with the project team.

## 4.2 Project reports and research papers

The ISOTOPE team have produced a number of written reports and research papers as part of the project, including this one. This is an ongoing process as we have several publications in preparation.

The reports and papers that have been completed are:

Holliman, R. and Jensen, E. (2009). ‘(In)authentic science and (im)partial publics: (re)constructing the science outreach and public engagement agenda, in Holliman, R., Whitelegg, E., Scanlon, E., Smidt, S. and Thomas, J. (eds.) *Investigating science communication in the information age: Implications for public engagement and popular media* (pp. 33-52). Oxford University Press, Oxford.

Jensen, E. and Holliman, R. (2009). ‘Investigating science communication to inform science outreach and public engagement’, in Holliman, R., Whitelegg, E., Scanlon, E., Smidt, S. and Thomas, J. (eds.) *Investigating science communication in the information age: Implications for public engagement and popular media* (pp. 55-71). Oxford University Press, Oxford.

Holliman, R., Jensen, E. and Taylor, P. (2007). *ISOTOPE Interim Report*. The Open University, Milton Keynes.

### 4.3 Conferences, seminars, symposia and invited papers

The project team have presented work at a number of seminars, symposia, conferences and other events. These presentations include:

Holliman, R., Jensen, E. and Collins, T. (2009). 'Informing science outreach and public engagement.' Symposium presented at the British Interactive Group Event at the Royal Institution, London, 22-24 July.

Jensen, E. and Holliman, R. (2009). 'The ISOTOPE Project: Informing Science Outreach and Public Engagement.' Paper presented at the Fourth Annual Science and the Public Conference, University of Brighton, 13-14 June.

Holliman, R. and Thomas, J. (2009). 'Everything you ever wanted to know about science and society, but were afraid to ask.' Science Faculty Open Forum. The Open University, Milton Keynes, 29 April.

Jensen, E. and Holliman, R. (2008). 'Practitioner perspectives on science outreach and public engagement: a focus group study.' Proceedings of the 10<sup>th</sup> International Public Communication of Science and Technology Conference—Bridges to the future, Malmö, Lund and Copenhagen, 25-27 June.

Jensen, E., Holliman, R. and Taylor, P. (2007). The ISOTOPE Project: Informing science outreach and public engagement. Paper presented at the Second Annual Science and the Public Conference, Imperial College, London.

Holliman, R. (2007). 'Science outreach and public engagement: a critical introduction.' Invited paper presented at the Roberts Science Outreach Colloquium, held at the University of Nottingham, 26 June.

Richard Holliman and Peter Taylor have also presented information about the ISOTOPE project to a number of visitors to the Open University, including Sir Roland Jackson from the British Science Association, and Paul Manners and Sophie Duncan from the National Coordinating Centre for Public Engagement.

# 5

## Evaluation

## 5. Evaluation

ISOTOPE was an action research project. As such, cycles of planning, action, observation and reflection, were central to the participatory design of the website (Figure 12).

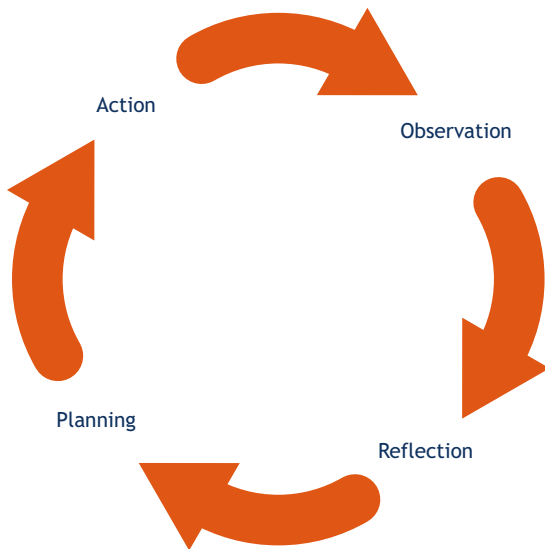


Figure 12: Illustration of the cyclical nature of action research

These cycles were described in Section 3.2, and included both formative and summative evaluation. A range of data collection methods were employed in the project to affect complementary assistance (Morgan, 1998), including self-report summaries, online and printed questionnaires, focus group interviews and participant observation. The data were analysed quantitatively or qualitatively, depending on the form. For a more detailed explanation of the methodologies and methods employed during the project, see Jensen and Holliman (2009).

### 5.1 Action research and the ISOTOPE project

We addressed two main goals with this qualitative research project. First, using focus groups and grounded data analysis we sought to expose the extant barriers - as well as positive examples of good practice - relevant to the (further) formation of a ‘community of practice’ in the field of science engagement. Second, we undertook the exploratory ‘action’ of constructing an open-source website for science engagement practitioners aimed at addressing some of the barriers identified by them.

First elaborated by field psychologist Kurt Lewin (1946), action research is a methodology based upon the dual aims of (1) increasing knowledge or understanding and (2) acting on the basis of that newly produced knowledge to effect change. The relative emphasis within the

continuum between these two aims of ‘action’ and ‘research’ varies from project to project. Regardless of which goal takes primacy, action certainly informs research/knowledge, and knowledge/research informs and assists action. Indeed, the various research phases with the project were understood as ‘influential interactions’ that were partly constitutive of the action goal of promoting the construction of a ‘community of practice’ in science engagement. Thus, the process of action research is cyclic, continuous and tightly interwoven within the entire research process. This kind of cycle was evident in the design of the ISOTOPE project, which involved a continuous cycle of planning/design, action, empirical data collection and analysis, and reviewing findings to inform further phases of planning/design, action, and so on.

## 5.2 Independent user testing

The project team employed a consultant to conduct independent user testing of the prototype website. The principal objective of the user test phase was to ensure that all functional areas of the ISOTOPE website could be considered ‘fit for purpose’ and functioning correctly from both a technical and usability perspective. This included validating that:

- all web pages on the ISOTOPE site functioned correctly;
- all function points were integrated correctly and supported navigation throughout the website; and
- all web pages were of appropriate quality prior to formal public rollout of the ISOTOPE site.

The results from the independent evaluation were very informative and we made a number of revisions to the website on the basis of these findings (see Sections 3.2.5 and 3.2.6)

## 5.3 Informal comments and feedback

We have continued to receive feedback, comments and suggestions for revisions to the website during and after presentations, via the feedback page on the website from registered members, and through the ISOTOPE mailbox ([science-engagement@open.ac.uk](mailto:science-engagement@open.ac.uk)). We expect this to continue throughout the lifetime of the website, in part because new users have different requirements, and communities change over time, introducing new requests, and sometimes losing the need for previous requirements.

# 6

## Impacts of the project



## 6. Impacts of the project

The impacts of the project, specifically the impacts of the website and the research publications, are difficult to assess as the project has only recently been completed. We are assessing the use of the site - the number of unique users and page impressions, respectively - using standard web analysis software. In the three completed months since its launch in July 2009, the site has averaged 45,000 hits per month. We will continue to collect statistical data on site usage, new members, etc. as one measure of the impact of the ISOTOPE site, both within and outside the UK. We will also monitor citation indexes for the research papers.

### 6.1 Engaging with knowledge transfer activities

We have submitted a proposal to continue the work of the ISOTOPE project, promoting knowledge transfer of the NESTA-funded phase, both through practitioner workshops and the development of web-based informational resources. By expanding the range of engagement methods available to science engagement practitioners, and sharing conceptual tools and research-based knowledge necessary to select the most appropriate methods for a given context, the efficacy of UK science engagement practice may be improved. This could have important secondary social, economic and policy impacts on those engaging, whether as ‘producers’ of events or as participants and contributors to them. In sharing social scientific knowledge about science engagement audiences derived from the NESTA-funded ISOTOPE research, this project may result in more effective communication approaches which in turn yield improved outcomes for the sciences and for the publics being engaged. Moreover, these additional knowledge transfer activities will have a strong likelihood of delivering widespread and long-term practice impacts magnified through the close collaborations with user partners that are highly respected within their practice communities.

The primary impacts on the practices of science engagement implicate secondary economic, social and policy impacts, detailed below. First, commercial practitioners of science engagement will have the opportunity to share knowledge and skills, thereby expanding their range of services and opening up additional market potential and the possibility of expanding their client base as a result. Second, the ISOTOPE research showed that there are clear social benefits that can be achieved for publics attending science engagement events - if the events are conducted effectively. Likewise, scientific experts can benefit from these exchanges, potentially adapting their practices and long-term goals as producers of (techno-) scientific knowledge. Benefits identified in our prior research include sharing knowledge, increased social capital and a greater sense of connection with local scientific institutions and communities. Our research showed that these benefits were much more likely to accrue in cases where the science engagement was well-executed, sensitive to needs of audience participants, and the methods of engagement were appropriate for the context.

There is also a potential benefit for publics (and for the sciences) in forestalling and re-directing potentially negative experiences of science engagement. Indeed, negative outcomes were

found in our prior research for engagement activities that failed to follow the good practice approaches identified as part of the ISOTOPE project. These negative outcomes include: negative perceptions of the engaging institution, publics perceiving that their time had been wasted and a perception that the engagement activity had ulterior motives. Helping science engagement practitioners avoid these negative outcomes has just as much potential for positive social impact as the promotion of positive outcomes. Of course, both of these categories of social impact have economic implications as well for commercial science engagement practitioners.

## 6.2 Spin-off activity

The ISOTOPE website has been included in an activity as part of an Open University (OU) postgraduate course in contemporary science communication ([isotope.open.ac.uk/SH804](https://isotope.open.ac.uk/SH804)). In one of the sections of the course, where they consider the relative merits of science outreach and public engagement, students are required to study the methodology of the ISOTOPE project and some of the research findings before they visit the website. Several students of this OU course, and other science communication courses in North America, have registered as members of ISOTOPE.

We also note that both Richard Holliman and Peter Taylor have made regular contributions as interviewees on a postgraduate research project being conducted at the Aston University by Gary Preece. We will provide Gary with a copy of this report. Gary has agreed to provide us with a copy of his thesis.

7

Future plans

## 7. Future plans

We argue that the project team has successfully delivered on all of the requirements of the project as detailed in the contract between the Open University and NESTA. Of course, this is only part of the story. In effect, the NESTA-funded phase of ISOTOPE has provided funds to collaboratively develop and launch a website that is based on the requirements of science engagement practitioners, and with a range of seed content. This site now includes a community of members and users, and one of the project's core aims to sustain the project is to promote it (and the site) more widely within the UK science engagement community and internationally.

As a project team we now need to take things forward to build the ISOTOPE community and to continue to develop the website to meet the diverse needs of members and users. With this challenge in mind, we are grateful to the Research School of the Open University for further funding to ensure the sustainability of the project in the medium term.

The ISOTOPE project team will continue to work on this project in the following ways:

- On securing further funding we will work with high-profile user partners to jointly develop and deliver impact generation activities relevant to the field of science engagement. In extending the current project team we will build on the sociologically-informed methodologies and research findings produced during the NESTA-funded ISOTOPE project, working collaboratively to include the perspectives, knowledge and experiences of the user partners and other contributions from science engagement practitioners.
- We will continue to promote the website to a range of possible users and user communities. These promotional activities will involve staff at the Open University, the wider national user community, and (potentially) the international user community. With this in mind we have submitted an application for funding to run a number of workshops that will provide opportunities for practitioners and other members of the science communication and public engagement community to meet, discuss and reflect on their existing practices, and to consider how they might contribute to the ISOTOPE website, and/or make use of the resources they find there.
- More immediately, we will continue to add content to the various areas of the website, and to invite other potential members to register and add relevant content. We also have a number of activity templates in production, and several that we are planning to commission.
- We are developing plans to revise the ways that members upload content to give them further options in the ways that they license this material (as discussed in Section 2.2.1, Footnote 2).
- We will seek further funding to sustain the website in the long term, e.g. to formally trial the site on a range of computing devices; to formally trial the site's performance via a range of end-user enabling technologies; to map the ways that the site is used and the site's content is used; and to introduce more sophisticated search and profiling functionality using semantic web technologies.

# 8

## References & Acknowledgements

## 8. References and acknowledgements

Bourdieu, P. (1977). *Outline of a theory of practice*. (R. Nice, Trans.) Cambridge, Cambridge University Press.

Bultitude, K., Featherstone, H. and Wilkinson, C. (eds.) (2009). *Evolving science communication: Learn, adapt, collaborate*. Report of the Evolving Science Communication symposium held at the Watershed, Bristol, 26 and 27 March 2009. University of the West of England, Bristol. Available from: [scu.uwe.ac.uk/Files/Evolving%20Science%20Communication%20report%20Sept%202009\\_0.pdf](http://scu.uwe.ac.uk/Files/Evolving%20Science%20Communication%20report%20Sept%202009_0.pdf).

Burchell, K., Franklin, S. and Holden, K. (2009). *Public culture as professional science: final report of the SCoPE project*. September, BIOS, London School of Economics and Political Science. Available from: [lse.ac.uk/collections/BIOS/scope/scope.html](http://lse.ac.uk/collections/BIOS/scope/scope.html).

Burchell, K. (2007). Empiricist selves and contingent ‘others’: the performative function of scientists working in conditions of controversy, *Public Understanding of Science*, **16**, pp. 145-162.

Carr, J., Whitelegg, E., Holliman, R., Scanlon, E. and Hodgson, B. (2009). *(In)visible witnesses: Drawing on young people’s media literacy skills to explore representations of science, technology, engineering and mathematics*. Research Report for the UKRC, Bradford. Available from: [oro.open.ac.uk/12008/](http://oro.open.ac.uk/12008/).

Collins, T.D., Mulholland, P., and Zdrahal, Z. (2009). Using mobile phones to map online community resources to a physical museum space. *International Journal of Web Based Communities*, **5**(1), pp. 18 - 32.

Collins, T., Gaved, M., Mulholland, P., Kerawalla, L., Twiner, A., Scanlon, E., et al. (2008). Supporting location-based inquiry learning across school, field and home contexts. In Proceedings of the MLearn 2008 Conference. Ironbridge Gorge, Shropshire. Available from: [oro.open.ac.uk/12393/](http://oro.open.ac.uk/12393/).

Davies, S. (2009). Learning to engage; engaging to learn: the purposes of informal science-public dialogue, in Holliman, R., Whitelegg, E., et al., op cit (pp. 72-85).

Department for Innovation, Universities and Skills (DIUS) (2008). *A vision for science and society: A consultation on developing a new strategy for the UK*. London, HMSO. Available from: [interactive.bis.gov.uk/scienceandsociety/site/category/consultation/](http://interactive.bis.gov.uk/scienceandsociety/site/category/consultation/).

Duncan, S. and Upton, J. (2009). Repositories of knowledge: sharing knowledge to avoid reinventing the wheel, in Bultitude, K. et al., op cit (pp. 32-7).

Gibbons, M. (1999). Science’s new social contract with society, *Nature*, **402** (Supp.), pp. C81-84.

Grand, A. (2009). Engaging through dialogue: International experiences of Café Scientifique, in Holliman, R., Thomas, J., et al., op cit (pp. 209-26).

Holliman, R. (2010, in press). Online media for the sciences, in Priest, S. et al. (eds.) *Encyclopedia of Science and Technology Communication*. Sage, Newbury Park, CA.

Holliman, R. and Jensen, E. (2009). (In)authentic science and (im)partial publics: (Re)constructing the science outreach and public engagement agenda, in Holliman, R., Whitelegg, E., et al., op cit (pp. 35-52).

Holliman, R., Jensen, E. and Collins, T. (2009). *Informing science outreach and public engagement*. Symposium presented at the British Interactive Group Event at the Royal Institution, London, 22-24 July.

Holliman, R. and Thomas, J. (2009). *Everything you ever wanted to know about science and society, but were afraid to ask*. Science Faculty Open Forum. The Open University, Milton Keynes, 29 April.

Holliman, R., Thomas, J., Smidt, S., Scanlon, E., and Whitelegg, E. (eds.) (2009). *Practising science communication in the information age: Theorising professional practices*. Oxford, Oxford University Press.

Holliman, R., Whitelegg, E., Scanlon, E., Smidt, S. and Thomas, J. (eds.) (2009) *Investigating science communication in the information age: Implications for public engagement and popular media*. Oxford, Oxford University Press.

Holliman, R. and Yates, S. (2009). Broadcast, print and online media: production, content and reception. Block 4 of SH804 *Communicating science in the information age*. Milton Keynes, The Open University, pp 137. Web: elil 963033.

Holliman, R. (2008). Communicating science in the digital age - issues and prospects for public engagement, in MacLennan J. (ed.) *A reader for technical writers* (pp. 68-76). Toronto, Canada, Oxford University Press.

Holliman, R., Jensen, E. and Taylor, P. (2007). *ISOTOPE Interim Report*. Milton Keynes, The Open University.

Holliman, R. (2007). Science outreach and public engagement: a critical introduction. Invited paper presented at the Roberts Science Outreach Colloquium, held at the University of Nottingham, 26 June.

House of Lords Select Committee on Science and Technology (2000, February 23). *Science and society*. (Third Report.) London, HMSO. Available from: [publications.parliament.uk/pa/ld199900/ldselect/ldsctech/38/3801.htm](http://publications.parliament.uk/pa/ld199900/ldselect/ldsctech/38/3801.htm).

Irwin, A. (2009). Moving forwards or in circles? Science communication and scientific governance in an age of innovation, in Holliman, R., Whitelegg, E., et al., op cit (pp. 3-17).

Irwin, A. (2008). Risk, science and public communication: third order thinking about scientific culture, in Bucchi, M. and Trench, B. (eds.) *Public communication of science and technology handbook* (pp. 199-212). London, Routledge.

Irwin, A. (2006). The Politics of Talk: Coming to Terms with the ‘new’ scientific governance. *Social Studies of Science*, **36**(2), pp. 299 - 320.

Irwin, A. and Michael, M. (2003). *Science, social theory and public knowledge*. Buckingham, Open University Press.

Irwin, A. and Wynne, B. (eds.) (1996). *Misunderstanding science? The public reconstruction of science and technology*. Cambridge, Cambridge University Press.

Jackson, R., Barbagallo, F. and Haste, H. (2005). Strengths of public dialogue on science-related issues. *Critical Review of International Social and Political Philosophy*, **8**(3), pp. 349-58.

Jensen, E. and Holliman, R. (2009). Investigating science communication to inform science outreach and public engagement, in Holliman, R., Whitelegg, E., et al., op cit. (pp. 55-71).

Jensen, E. and Holliman, R. (2009). *The ISOTOPE Project: Informing Science Outreach and Public Engagement*. Paper presented at the Fourth Annual Science and the Public Conference, University of Brighton, 13-14 June.

Jensen, E. and Wagoner, B. (2009). A cyclical model of social change. *Culture and Psychology*, **15**(2), pp. 217-228.

Jensen, E. and Holliman, R. (2008). ‘Practitioner perspectives on science outreach and public engagement: a focus group study.’ Proceedings of the 10th International Public Communication of Science and Technology Conference—Bridges to the future, Malmö, Lund and Copenhagen, 25-27 June.

Jensen, E., Holliman, R. and Taylor, P. (2007). The ISOTOPE Project: Informing science outreach and public engagement. Paper presented at the Second Annual Science and the Public Conference, Imperial College, London.

Leach, M., Scoones, I. and Wynne, B. (eds.) (2005). *Science and citizens: Globalization and the challenge of engagement*. London and New York, Zed.



Leadbetter, C. and Miller, P. (2004). *The pro-am revolution: How enthusiasts are changing our economy and society*. London, Demos. Available from: [demos.co.uk/publications/proameconomy](https://demos.co.uk/publications/proameconomy).

Lewin, K. (1946). Action research and minority problems, *Journal of Social Issues*, 2, pp. 34-46.

Measure, S. (2007). *The CreScENDO Project: Final report for NESTA*. London, National Endowment for Science, Technology and the Arts.

Morgan, D. (1998). Practical strategies for combining qualitative and quantitative methods: Applications to health research. *Qualitative Health Research*, 8(3), pp. 362-376.

Nisbet, M. and Scheufele, D. (2009). What's next for science communication? Promising directions and lingering distractions. *American Journal of Botany*, 96(10), pp. 1-12. Available from: [amjbot.org/cgi/reprint/96/10/1767](http://amjbot.org/cgi/reprint/96/10/1767).

Parliamentary Office of Science and Technology (POST) (2006). *Debating science*. Available from: [parliament.uk/documents/upload/postpn260.pdf](http://parliament.uk/documents/upload/postpn260.pdf).

Powazek, D. (2002). *Design for community: The art of connecting real people in virtual places*. New Riders.

Royal Society (RS)/Royal Academy of Engineering (RAE) (2004, July). *Nanoscience and nanotechnologies: Opportunities and uncertainties*. Royal Society Policy Document 19/04. Available from: [nanotec.org.uk/finalReport.htm](http://nanotec.org.uk/finalReport.htm).

Royal Society, RCUK and Wellcome Trust (2006). *Factors affecting science communication: A survey of scientists and engineers*. London, The Royal Society. Available from: [royalsociety.org/General\\_WF.aspx?pageid=7967](http://royalsociety.org/General_WF.aspx?pageid=7967).

Sciencewise Expert Resource Centre. (2009). *The Government's approach to public dialogue on science and technology*. London, Department of Innovation, Universities and Skills. Available from: [sciencewise-erc.org.uk/cms/knowledge-hub/](http://sciencewise-erc.org.uk/cms/knowledge-hub/).

Somekh, B. (2006). *Action research: Methodology for change and development*. Buckingham, Open University Press.

Stilgoe, J. (ed.) (2009). *The road ahead: Public dialogue on science and technology*. Sciencewise Expert Resource Centre. London, Department of Business, Innovation and Skills. Available from: [sciencewise-erc.org.uk/cms/the-road-ahead/](http://sciencewise-erc.org.uk/cms/the-road-ahead/).

Stilgoe, J. and Wilsdon, J (2009). The new politics of public engagement with science, in Holliman, R., Whitelegg, et al., op cit (pp.18-34).

Stilgoe, J., Irwin, A. and Jones, K. (2006). *The received wisdom: opening up expert advice*. London, Demos. Available from: [demos.co.uk/publications/receivedwisdom](https://demos.co.uk/publications/receivedwisdom).

Trench, B. (2008). Towards an analytical framework of science communication models, in Cheng, D., Claessens, M., Gascoigne, T., Metcalfe, J., Schiele, B. and Shunke, S. (eds.) *Science communication in social contexts: New models, new practices* (pp. 119-135). Dordrecht, The Netherlands, Springer.

Turney, J. (ed.) (2006). *Engaging science: Thoughts, deeds, action*. London, The Wellcome Trust. Available from: [wellcome.ac.uk/About-us/Publications/Books/WTX032706.htm](https://wellcome.ac.uk/About-us/Publications/Books/WTX032706.htm).

Wellcome Trust/MORI. (2001). *The role of scientists in public debate: Full report*. London, The Wellcome Trust. Available from: [wellcome.ac.uk/About-us/Publications/Reports/Public-engagement/wtd003429.htm](https://wellcome.ac.uk/About-us/Publications/Reports/Public-engagement/wtd003429.htm).

Whitelaw, L. and Collins, T. (2009). Pragmatic support for taxonomy-based annotation of structured digital documents, in Sicilia, M.-A. and Lytras, M. (eds.) *Metadata and semantics* (pp. 201-210). Secaucus, NJ, Springer. Available from: [springerlink.com/content/wjw2365013222181/](https://springerlink.com/content/wjw2365013222181/).

Whitelegg, L. Holliman, R., Carr, J. Scanlon, E. and Hodgson, B. (2008). *(In)visible witnesses: Investigating gendered representations of scientists, technologists, engineers and mathematicians on UK children's television*. Research Report Series for No. 5. Bradford, UKRC. Available online at: [oro.open.ac.uk/10681/](https://oro.open.ac.uk/10681/).

Wilsdon, J., Wynne, B. and Stilgoe, J. (2005). *The public value of science: Or how to ensure that science really matters*. London, Demos. Available from: [demos.co.uk/publications/publicvalueofscience](https://demos.co.uk/publications/publicvalueofscience).

Wilsdon, J., and Willis, R. (2004). *See-through science: Why public engagement needs to move upstream*. London, Demos. Available from: [demos.co.uk/publications/paddlingupstream](https://demos.co.uk/publications/paddlingupstream).

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38	Sr Sarah	52	Te Terence
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41	R Richard	54	Xe Xavier
42	T Trevor	83	Bi Brigid
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