

## **When do facts matter?: acquisition of scientific information by non-scientists**

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### **Abstract:**

This study combines qualitative and quantitative methods in an investigation designed to explore the idea that members of the public are active rather than passive players in their engagements with science.

This paper reports preliminary findings from a study of various groups of people in Edinburgh who might be thought to have a particular interest in scientific information. A series of in-depth interviews with active members of Friends of the Earth was followed by a questionnaire filled in by 244 people at this year's Edinburgh International Science Festival (EISF), 15 of whom were also interviewed in more depth.

The results show that the Edinburgh International Science Festival was an interesting magnet for different types of people with a variety of interests in science and purposes in attending. Over half of 244 visitors who filled in a questionnaire are 'active citizens' to the extent of belonging to at least one type of interest group.

Members tended to be older and better qualified, male rather than female, and more focused in their 'image of science'. These people engage in various types of voluntary activity and use more sources of information about science, including their organisations. However, such membership does not seem to affect various 'lifestyle' choices. In the sample, there are more male than female members in all the types of society except religious organisations. Women are much less likely to be members of only 'scientific' type societies – they tend to have broader interests. Members of professional scientific societies tended to be male, older and retired, and to have at least first degrees in science. They tend to prefer being members of political parties rather than environmental groups. Members of amateur scientific societies tended to be younger, with Highers (Scottish school-leaving exam) as their highest scientific qualification. They are more likely to join environmental groups than political parties.

Of the 15 people interviewed, most thought it to be their duty to support campaigning groups, though fewer than half had actually joined. Some people thought it to be their duty to campaign, and a few of them did it. Most got a 'buzz' from science and a majority was dissatisfied with the information available to them on scientific topics, particularly from industry. Most would like more democratic control over research as well as better access to information. Others are also concerned about setting an example to children with regard to interest in science.

The most active members of Friends of the Earth, however, did not seek much in the way of information that would be generally understood as scientific. Their motivations did not seem to be based on such information at all, though they recognised its value and relied on their organisations to provide reliable data to keep them informed and help them conduct their campaigns.

It is concluded that science communicators should be aware of a variety of motivations for engagement with scientific information. Often the most pertinent information and the strongest agendas are not to do with information produced using the scientific method. However, there is evidence of active information-seeking in science, appreciation of and use of scientific information that goes beyond the passive acquisition of information that is sometimes implicit in the way science communications are structured.

## **1. The person in the street: passive receptacle for knowledge or active citizen ?**

This study combines qualitative and quantitative methods in an investigation designed to explore the idea that members of the public are active rather than passive players in their engagements with science.

Educational theory suggests that active engagement with knowledge promotes learning and motivation. Moreover, the number and size of interest groups is increasing: ordinary citizens are seizing the initiative in acting to change society. It seems inconsistent with this observation that the public's engagement with science should be entirely passive. The views of the non-scientific observer, disadvantaged as he or she may be as a scientific 'citizen', will, after all, have an effect on the system itself in the long run.

Use of the media and attendance at museums, science festivals and classes have already been investigated as an aspect of public engagement with science (Durant and Bauer, 1997, p3). I broadened this agenda by adding categories such as membership of interest groups and other sources of information such as academic literature, scientists, teachers and the Internet. I also wanted to go beyond what people did to get a better sense of the way people 'place' scientific information in their lives. To do this I broadened the spectrum of questions to include the following:

1. To find out what people do to inform themselves about science
2. To explore other behaviours that may result in acquisition of knowledge or active participation in science
3. To explore behaviours that may be the result of such acquisition of knowledge
4. To see how people view the role of science in human activity and development
5. To ask to what extent people regard it as their civic duty to know about science and what on what they find out and communicate their knowledge to others
6. To find out to what extent people think that it is their right to be consulted on technical matters and have access to facts that are relevant to arriving at informed opinions and sensible behaviours with regard to such matters
7. To find out how the answers to such questions link up with their values and goals

I worked hard to develop questions that would probe such matters without being too intrusive, complex or controversial. One relatively easy way of doing this was to look at commitments people had made to such activities by joining relevant organisations and that is the aspect I plan to focus on in this paper.

So far I have managed to exploit this angle in two ways. One is by using the organisations concerned as ways of finding people to talk to. I approached the local Friends of the Earth group in Edinburgh. I asked some of their members to what extent they felt the need to get hold of scientific information.

Another approach was to pinpoint a group of people who demonstrated a particular penchant for scientific engagement by turning up at the Edinburgh International Science Festival (EISF). The festival takes place every year in the spring and is well known among citizens of Edinburgh and the surroundings. This year, the tenth Festival it took place between 4<sup>th</sup> and 19<sup>th</sup> April and included 130 talks as well as a broad range of children's events.

I asked nearly 250 visitors, half women and half men, to fill in a questionnaire. This included questions on groups they were members of, if any, among other questions about themselves including their sources of information about, interest in and image of science. I also asked them about voluntary activities and certain types of behaviour, including domestic practices such as recycling waste and car use and use of scientific equipment. The idea was to look for connections between such membership and other aspects of scientific engagement.

## **2. Highlights from the questionnaire results**

To set the further discussion in context, I present some of the more interesting findings from the 244 questionnaires.

Highest scientific qualifications ranged from none to doctorate.

Three-quarters did not share household with a child (under 17).

Four-fifths (195) were interested in scientific ideas, and three-fifths (142) were concerned about global issues such as the environment.

One fifth were members of a scientific society. Significantly more of these were men than women.

A slightly smaller number belonged to environmental groups.

Almost all (89%) used the mass media as a source of news about science

One half kept themselves informed about science by consulting academic literature.

One third obtained news about science from organisations of which they were members. Significantly more of these were men than women.

Two-fifths gave to charities that sponsor research.

Three-fifths recycled at least some of their waste. Women were significantly more likely to do this than men.

### **3. Getting to grips with groups**

What do I mean by the term engagement with science ? I mean that people who pay attention to science, for example by taking part in science activities, make a choice to invest their resources of time and money in an activity connected with science.

Though this commitment may not be at the level of somebody engaged on a scientific career, it is still a real choice. The people who make such choices may not be representative of the entire population, but nevertheless they extend widely in terms of educational attainment in science, type of career, social class and occupation. All the people who attended EISF were making some investment of this nature. In this paper I am focusing on those who go one step further by being a member of a group.

Over half of the people who filled in the EISF questionnaire (134) were members of one of the following types of the following type of group: professional scientific society (59), environmental group (45), amateur scientific group (22), non-environmental campaigning group (23), political party (26), religious organisation (39).

All of organisations can be considered as different kinds of interest groups. Here is one useful definition of such groups: 'any group that, on the basis of one or more shared attitudes, makes certain claims upon other groups in the society for the establishment, maintenance, or enhancement of forms of behaviour that are implied by the shared attitudes' (Truman, D. B., 1951).

The various types of group have different priorities. Professional scientific societies are perhaps the nearest to the traditional interest group that is only open to people with particular qualifications and focuses on promoting the interests of members. Amateur scientific societies are also focused on promoting the (usually non-professional) interests of members. Environmental groups aim to promote the interests of both members and non-members, as even more so do non-environmental campaigning groups such as Amnesty International. Political parties have traditionally promoted the interests of members, though social concern may also be

part of their agenda. We can perhaps reverse this description with regard to religious organisations.

I considered members of the first three types of group to have made a substantial investment in their involvement with science. Membership of the other three groups, which was usually additional to one of the first three, I considered interesting as evidence of a certain extra propensity to 'activism'.

I found different patterns of group membership among women and men.

Members of professional scientific organisations were far more likely to be men, while the reverse was the case, though not so extremely, for religious organisations. Differences were not so marked for the other types of groups.

It was also interesting to see correlations between memberships of the two types of group. These too show gender differences. Women were more inclined to be members of both science-oriented and non science-oriented groups than men. Members of only one type were evenly split between the two types. Meanwhile, more than half male members were members of science-oriented groups. Of the rest, three-quarters were members of both and fewer than ten per cent members of non-science oriented groups only.

How do the members of the various groups differ from each other ? Is there any pattern to indicate that different types of people join different groups ?

I looked in detail at membership of the 'scientific-type' groups, and to what extent the memberships were similar and different in terms of the attributes addressed by the questionnaire.

To summarise, within my sample there are differences between members of the various organisations studied. Males predominate in all the types of society except religious organisations: they particularly predominate in professional scientific societies. Women are much less likely to be members of only 'scientific' type societies – they tend to have broader interests. Members of professional scientific societies tended to be male, older and retired, and to have at least first degrees in science. They tend to shun campaigning groups but not political parties. Members of amateur scientific societies tended to be younger, with Highers (the Scottish school-leaving exam) as their highest scientific qualification. They are keener on

environmental groups than political parties. A third of the members of amateur scientific societies are also members of professional scientific societies.

People with different qualifications, genders and of different ages are making different kinds of choices about what kind of group identity they want to sign up to, and whether or not their interests are oriented towards members of their own interest group or wider aspects of society and world affairs. This is in line with other findings in groups with particular interest in other areas such as agriculture. Some join Friends of the Earth –these tend to be women with left-wing leanings. Others join the National Farmers Union – these tend to be men with right-wing leanings (Jordan and Maloney, 1997, p 2-3). We will discuss this further below.

#### **4. Are group members different from non-group members ?**

I wanted to see if people who joined groups were different from people who didn't. In other words, could I pick out some features related to engagement with science that went along with a propensity to 'activism' in the public domain ?

Within my sample, members tended to be older and better qualified, male rather than female, and more focused in their 'image of science'. These people engage in various types of voluntary activity more than non-members, and they tend to use more ways to keep up with science, particularly using their organisations as sources. Such membership hardly seems to affect various 'lifestyle' choices such as recycling, using roof insulation, vitamin supplements, a car or computer.

These results show that there is some scope for developing a measure of 'activism' among individuals in terms of their engagement both with the public domain as a whole and of their engagement with science. It is interesting to note that lifestyle choices seem to be made fairly independently of such activism. It would be interesting to see if this result was the same for a sample not already demonstrating some engagement with science.

#### **5. Further aspects of engagement**

I also had the opportunity to talk to some of the people who filled in questionnaires. I asked them about a number of topics, including group membership and wider aspects of democratic involvement with science. One interesting point was that there is a substantial number of people who are members of groups because they feel

that it is their 'duty as a citizen' to support groups that campaign on issues that concern them.

Eleven of the 15 people I interviewed felt this. Nine of these were members of one of the types of group mentioned, three of which belonged to environmental groups and one to a non-environmental campaigning groups.

Only 5 thought it to be their 'duty as a citizen' to take part in campaigns. As it turned out, only 2 actually did campaign. One of these was a member of a political party and the other a member of an amateur scientific society. Of the other three 'ought-to' campaigners, one was a member of a professional scientific society and the other two did not belong to any of the kinds of the society mentioned in the questionnaire.

Altogether seven out of the 15 did felt that industry's unwillingness to release information was a problem, and 9 of them thought that there should be a lot of improvement in the activities of organisations such as industrial companies.

Another interesting finding was that 12 out of the 15 interviewees, whatever their scientific qualification, seemed to get a 'buzz' from science, though the range of aspects of that was more limited from those who weren't professionals. This 'buzz' was often connected with the interests in science they shared with their children through school work. Many regretted not have been taught better themselves and thus not being able to help their children as much as they would have wanted. For others their children's work had been a spur to greater involvement.

To summarise, information collected in interviews at the Festival showed that many people thought it to be their duty to support campaigning groups; though fewer actually joined. Some people thought it to be their duty to campaign, and some of them even did it ! Though most got a 'buzz' from science, there was also a majority that were dissatisfied with the information available to them on scientific topics, particularly from industry. Most would like more democratic control over research as well as better access to information. Others are also concerned about setting an example to children with regard to interest in science. All of this suggests that there are further aspects of engagement with science that motivate people to be, at least wish to be, actively engaged with science.

## **6. What makes people 'activists', and what do they need to know ?**

I spoke to a small number of highly committed people who currently turn up to meetings of the Edinburgh branch of Friends of the Earth (FoE). This group is distinct from the far greater number of members of the national organisation, Friends of the Earth Scotland. The local group organises meetings and campaigns, mostly on topics of local interest. Later on I plan to do comparison interviews with members of amateur scientific societies.

One person told me that ‘the aim of FoE is to take action to ensure that ...the future has a good enough environment for the next generation and to educate people on the environmental front’. All had become conscious of problems with the environment, through the media for the most part. Their decision to join seemed to have to do with a certain set of values, a certain set of feelings of responsibility and good citizenship. One member expressed her concerns thus: ‘The gap between the haves and have nots is widening, economic growth is likely to create an environment that is unsustainable, and the future for the next generation is very difficult.’

On the basis of such feelings, activists felt it was their duty to make an effort to bring about change in their own behaviour. They themselves had adopted ‘green behaviours’ such as recycling paper and reducing their use of cars. They had gone beyond this in order to persuade others to do the same and to bring about changes in policy and legislation by campaigning on local issues and compiling and disseminating information.

Such behaviours seem to enhance their own sense of worth and accomplishment, as well as bringing them into contact with like-minded people. Some seem to see their usefulness more as critics, changing the nature of the organisation itself. Moreover, the people who are active also tend to be active in other types of campaigning, such as working with charitable organisations and sometimes supporting animal rights. I mention this in particular because it seems to bring out an important factor in these activities: the emotional, social and political elements of commitment to causes that accompanies the intellectual commitment we see as the usual product of imparting scientific information. As one member said, membership of FoE ‘gives me opportunities to exercise my right to get hold of information to care for the environment, to care for the community and exercise my freedom to speak and inform’.

Much of the information that they dealt with was not what we would think of as scientific information. It was about events and meetings, about details such as volume of traffic, levels of pollution, the practical details of recycling. Campaigning

took the form of writing letters to MPs and others and setting up events calculated to gain publicity. More globally oriented information was taken up from the media, though this was not entirely trusted, and more particularly from information provided within the organisation, either in written form or from like-minded experts. However there was a perception that some information was being withheld. Asked if she enjoyed the right to receive and impart information, she replied 'slightly'.

They got their information from the media and their organisation. Some of them, an elderly journalist turned farmer for instance, could also draw on more direct observations and research. Many regretted not have done more science at school, and complained about the teaching, but no-one particularly felt this hindered them as campaigners. As exemplified in their own newsletter, painstakingly and conscientiously compiled by one of the members I interviewed, facts and figures are important. But the science behind the issues is secondary, and only called in when attention has been successfully focused on the issues at hand.

I gained extra insights on the general background from two scientists who were also members. One had transferred the focus of his efforts from academic work to freelance support of environmental groups when he saw that it was very difficult to bring about change as an academic. He was concerned that campaigns should be based on correct science. Speaking of the campaigning group Greenpeace, he said that 'there was a shift I think to make sure that their science was hard and accurate and when they actually said something about science it was actually correct.' However, he points out that the real debate is not about the inaccuracies or otherwise of the science, it's really about the ethical questions.

Another academic member, quite senior in FoE Scotland and a link with the local group, also focused on guiding philosophies. He said that, 'I think one of the advantages of taking a sustainable development perspective is that you're dealing with a certain outlook rather than the danger of concentrating on a single issue and then getting bogged down in accusation and counter accusation. We can use science to test case studies, but I don't think science itself needs to address the issue of the waste hierarchy: reduce, reuse and recycle. Maybe common sense is the wrong word, but it's one of our central assumptions, which is probably not testable by science.'

## **7. Discussion**

The study was successful in gaining access to a number of people who have made the decision to make some investment in adding to their knowledge of science or being active in bringing about change in science-related policy areas. It showed that such people vary widely in their personal agendas for involvement with science, and the kind of actions they take. Concern about global issues such as the environment figured in the motivations of 142 of 244 visitors, not far behind 'scientific ideas' (195).

Well-qualified and committed scientists figure prominently among those who are on the look-out for information about science, but there are plenty of others who also seek it, and the Edinburgh International Science Festival offered them a good opportunity to acquire it alongside the professionals. The 'lay' element of the audience did not consist of passive receivers of scientific information. Many of the people who came were 'active citizens' in the sense of being members of various kinds of interest group. Many of them got information about science from their group and some took an active part in compiling and disseminating information. Members of amateur scientific societies used this in their hobbies, and members of other kinds of group, such as environmental groups used it for taking part in campaigns.

Data from the interviews conducted at the Festival showed that people with children, for example, had strong agendas connected with exchanging information about science with other family members in connection with the educational process. It also showed that the non-scientists had an active relationship with science and were concerned that they did not have access to the information they needed. They were more inclined to be active in the wider domain than the scientists. Rarely, however, was it basic research data that they felt they needed better access to. More often, it was the knowledge that was not yet certain, that was under commercial or political wraps, or that they just did not have the time to gather. It was also important, they thought, to hear the scientists' views on controversial issues in the public domain.

The more detailed interviews with active members of Friends of the Earth complemented this picture. They showed that to be relevant to their work the information had to include more than just the scientific facts. Matters of circumstance and politics were just as important, sometimes more so. This conjunction is well illustrated in the nature of the publications of Friends of the Earth, which many members reported drawing on for their work. These documents tend to combine some of the basic scientific facts with their local relevances

(Dixon, 1996, Friends of the Earth, 1990 and 1991). Moreover they also address metaissues such as the availability of the crucial information (Grohs, 1996).

Pressure groups such as FoE have grown dramatically in number and size over recent years. In 1991, 5 per cent of Scots said they were members of environmental groups (Wilkinson and Waterton, 1991, Appendix A, Table 19). Friends of the Earth (England, Wales and N. Ireland) had 140 000 members in 1993, and Greenpeace had over 400 000. Interestingly, women form the bulk of FoE members (nearly 60 per cent) (Grant and Maloney, 1997, p13). Memberships have declined slightly since then, along with the general level of concern about the environment (Taylor, 1997, p113) As we have seen, people we might otherwise have perceived as being 'merely' 'members of the public' are making sometimes substantial contributions of time and money to interacting with like-minded people.

A number of reasons has been given for this type of activity and its recent growth, and concomitant reduction in party political involvement: increasing affluence and education leading to greater attention on quality of life issues rather than immediate material ones; changing social structure diffusing party allegiances; and a perception that 'ordinary people are more willing today to protest about decisions which affect their lives' (Baggott, pp169-72).

Environmental organisations also seem to play significant role as information providers well beyond their own membership. In 1991 half of all Europeans regarded a consumer or environmental organisation as their main reliable source of information on biotechnology. Next came schools and universities at 17 per cent (Marlier, 1992, p100). Scots seem to follow this pattern. In 1991 57 per cent of Scots said they would trust environmental organisations most to tell them about environmental issues, with 23 per cent trusting scientists most (Wilkinson and Waterton, 1991, Appendix A, Table 22).

It is interesting to speculate about the relationship between these findings on participation and trust and the high degree of interest in and self-reported knowledge about the environment as evidenced by the Eurobarometer survey on public understanding and attitudes of Europeans on science and technology, conducted in 1992. Europeans in every country in Europe (the UK is the exception) were more likely to be very interested in environmental pollution than in medical discoveries, new inventions and technologies, and new scientific discoveries. More than twice as many considered themselves to be very well informed on the subject than on any of the others (INRA, 1993, pp139 and 141).

## 8. Conclusions

By joining up with a group such as Friends of the Earth, people can become active with respect to science rather than just be passive listeners. This adds a new dimension to their motivation both as learners and as doers. Such activism may not share all the aspects of our traditional view of commitment to science, as evidenced for example by membership of a professional or even amateur scientific society. However, even though members of environmental groups do not make a point of seeking technical information, they monitor what is going on in the media and through information provided by their own organisation.

Scientific information on its own does not give such people the more rounded and exemplified knowledges they need. They may complement it with their own experiences. Indeed, 'real-world' knowledges can contribute to the work of the scientists by posing questions in new ways, and shaping boundaries for decision-making discourses. In a focus-group based study of responses of genetically-modified organisms in foods, members of the public expressed a need for more information. But the questions they wanted the answers to were not about the technicalities. Rather, 'the "information" being called for might best be described as a call for 'experience that convinces me genuinely that I can trust the judgement and vision of the people and procedures governing decisions taken on my behalf', the researchers concluded (Grove-White et al, 1997,p30-1). Meanwhile scientists continue to focus on the narrower domains where their expertise puts them in charge, and often others, such as regulatory agencies collude.

What implications does this have for scientists and science communicators ? It suggests that a fruitful direction for developing their work is to exploit opportunities offered by the agendas set in the public domain for areas of activism. They may well be in a good position to provide the knowledge to set these topics in context, but it may be necessary to look more widely than is currently customary for information and examples to flesh out the science. Such work also provides opportunities for scientists to revise the agenda to some extent in line with their more up-to-date and in-depth insights. If they do not make the effort to contextualise their results in a way that will engage a wider audience, they risk the implications of their results being lost from the wider debate. Another risk is that by seeming to stay aloof from the debate, scientists will lose the trust of the public.

To summarise, then, scientists want the public to pay attention to science, and become more familiar with it. Increasingly there are people who are willing to make such an investment, in general terms or because of a particular set of circumstances. There are people who are willing to listen and learn. Such people will use what they have learnt in what they do, but it may not be that they see the whole situation the same way the scientists do. There are wider knowledges that inform their thinking. Just as scientists think and act the way they do because they have 'signed up' to the scientific method, FoE may think and act the way they do because they have 'signed up' to the idea of sustainable development.

## **9. Lay empowerment in science**

To point up more sharply what I am saying here, I am going to propose an outrageous analogy. I am going to see what happens if we substitute the word man for scientist and woman for non-scientist. Now we can draw on lots of research about different communications styles and strategies. For example, sociolinguist Deborah Tannen writes 'male-female conversation is always cross-cultural communication...women often have a relatively greater need for involvement and men a greater need for independence'. This, Tannen asserts, leads women to put more emphasis on metamessages such as enthusiasm, openness, warmth, sometimes even than on the factual content of talk (Tannen, 1992, p109-12). Increasing activity in public understanding of science activities, one could argue, is a sign in itself of willingness to engage with the public. Feedback from talking to members of the public can teach scientists about how to use 'metamessages' to help involve their interlocutors both in their presentations - 'more illustrations, less text, more hands-on' - and in their conversation - 'use less jargon, smile more' (Pearson et al, 1997, p284)

There is a deeper, more serious literature on how gender differences have led to long-term power imbalances that have brought about now unacceptable consequences in society. Women have for example often been excluded from active citizenship and thus denied what some have described as a basic human need. The agency of women is not something easily denied for ever, even though the system may be stacked against them. In investigating the effects, the first step, as Ruth Lister says, is to study 'both agency and structural conditions and the interplay between the two...such an approach helps us move on from 'victim feminism'...recognising women's agency and achievements as citizens, both individually and collectively,

without losing sight of the deep-seated inequalities that still undermine many of their citizenship rights' (Lister, 1997, p7).

The question of structural conditions, brought back to our particular interests, leads us returns us to the political and regulatory framework in which institutional policy on scientific issues is made – in other words, the 'question of political and scientific culture, of which these mechanisms are reflections'. Could it be true, as some have argued, that risk assessments on genetically-modified organisms 'do not take into account the possibility of disasters on the scale of Three Mile Island or Chernobyl' (Grove-White et al, 1997, p24). If this is so, is it so surprising that intelligent and even scientifically relatively engaged people are dissatisfied ? Surely such risks are part of the picture formed when 'people, quite routinely, hold in tension simultaneously a range of cognitive perspectives, (as 'consumers', as 'citizens', and so on) switching between different orientations, depending on the context of discussion and the perceived possibilities for action – often reflecting realistic awareness of being unable to control or influence the forces in play (Grove-White et al, 1997, p18).

Scientists now claim to be actively seeking the skills of women to enrich their own community. Perhaps the next step is to take account of the active work of non-scientists in and around the world of science, and to make the effort to acknowledge and address it on its own terms through creative application of the particular contribution they make, as supporters, users, readers, amateur participants, customers, taxpayers and sometimes even critics. Perhaps we as researchers of this process can take the lead here by more consciously describing and accounting for agency among the non-scientists whose engagement with science we study. After all, as Anthony Giddens has written, ' the production and reproduction of society has to be treated as a skilled performance on the part of its makers, not merely a mechanical series of processes' (Giddens, 1976, p160).

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