# SCIENCE SHOPS AS UNIVERSITY-COMMUNITY INTERFACES: AN INTERACTIVE APPROACH IN SCIENCE COMMUNICATION

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## ABSTRACT
Science shops provide independent, participatory research support to civil society. They both *use* traditional science communication techniques to produce usable results, and they *are part of* an interactive science communication system: They help articulate civil society issues and support the use of results, and they put citizens requests on the research agenda. They can have a special position as facilitators in risk communication as an independent, trusted source. Science shops benefit research, higher education and civil society simultaneously. The E.U. supports science shops to help close the gap between science and society. Science shops proved viable in different countries, provided there is demand for knowledge and supply of researchers (e.g. students for credits), with willing hosts (like universities) and available paid staff. There should be more studies on this method for interactive science communication from the democratic motive, to strengthen it and improve its impact.

## INDEX TERMS
science shops, interactive science communication, risk communication

## INTRODUCTION
With the start of the Science and Society Program in 2001, the European Commission started to look for ways to create a better interaction between science and society. One of their focal points is the “Science Shop”, a Dutch invention from the 1970s, which has spread to a number of other countries as well. A science Shop is a “unit that provides independent, participatory research support in response to concerns experienced by civil society”. It is often part of a university and uses the word “science” is used in its broadest sense, so including social sciences, humanities and engineering.
In this paper, we will see if science shops are a tool towards more interactive science communication. As an example, we will elaborate on the specific role that science shops can have in risk communication. We will discuss the portability of the science shop concept, and their current strengths and weaknesses.

## THE SCIENCE COMMUNICATION PROCESS
In this section we will describe the way in which science shops operate, and present one case in more detail. We will conclude with some international developments.

### *Operation of a science shop*
In a science shop, questions from civil society organisations are rephrased to scientific research projects. Students, under supervision of a professor then perform the research, or a researcher does it. Students usually obtain credit points for their research that count towards their degree. The research will lead to a report (or another type of product) which is made to

be of use to the client. The student will have gained valuable skills (problem definition, project based working, communicating, planning). The professor and/or the researcher will have case material for future scientific publication or further theoretical analysis. Moreover, supervision is part of the teaching obligation. So, in fact all actors are doing what they are supposed to do: teaching, learning and researching. This is why a Science Shop can be implemented in university at relatively low additional costs, so universities can also serve the non-profit sector. Science shop staff solicits or receives new requests, manages the process, actively supports clients in the use of the results, and formulates follow-up research.

The criteria that most Science Shops apply are that clients may have no commercial aims with the research, and the research results must become public. Also, clients must be able to use the results of the research to achieve their mission – which means having some form of organisation; for the Science Shop itself it means that it must produce results that are clear, and applicable in context. Payment ranges from absolutely free to full costs, depending on the clients possibilities. The target groups fit well in the European Commissions definition of civil society organisations (2001): o*rganisations whose members have objectives and responsibilities that are of general interest and who also act as mediators between the public authorities and citizens. They may include trade unions and employers' organisations ('social partners'), NGOs, professional associations, charities, grassroot organisations, organisations that involve citizens in local municipal life; churches and religious communities.*

Science shops both *use* traditional science communication techniques (producing understandable, usable products) and they are *part of* the interactive science communication system. This is visible especially at the start and end of the mediation process.
In reaching clients, Science Shops may be confronted with unrealistic expectations that citizens have of science. Or, to phrase it differently, the public's awareness of science sometimes has the form of expecting a magic bullet to instantly solve all their problems. When this turns out to be different citizens might turn away. The other extreme of this situation occurs when public awareness of science and technology is low. In a research by Farkas (2002) it appeared that some organisations of disabled people knew how to ask questions relating to health care, but they never thought of applying for help to a technical university (for modified technical tools to support them). In this case, the public can be said to be unaware of what science and technology could do for them. Science Shops can play an active role here. After the research project, science shops play a role in defining interesting follow-up research. An example of this antenna function is e.g. the way that individual questions on side-effects of prescription drugs on pregnant women first lead to a four-year project and then to a regular research field in the Department of Pharmaceutics of Groningen University. At Technical University Denmark, the science shop acted as an incubator for research on ecological food production (Hende and Jørgensen, 2001).

*Case-example*
We will give one example to gain further insight in communication process of science shop work, with an emphasis on risk communication.
In 1998, citizens from the city of Steenwijk approached the Chemistry Shop Groningen. They were looking for experts to help them assess the health risks from two local carpet factories. The science shops were recommended to them by a nationwide NGO ("Monitoring Network Environment and Health"). During the problem articulation phase, the citizens described the problem as "toxic emissions that cause cancer, smell ugly, and cause visible water pollution". The cancer risk was considered dreadful, involuntary, the source was industrial, and the victims were identifiable (neighbours, relatives). The outrage caused by authorities not being

responsive to these fears is in line with the results produced by Slovic over the years (Slovic, 2000). The fact that the three issues were considered together as one big problem had made it impossible to discuss them individually with the other stakeholders (local authorities and companies). The only communication was made through newspaper interviews (and especially headlines). In fact, the problem was thus at least partly a communication problem. To find a way out, we decided to make three individual research tracks: cancer (past emissions – present emissions), smell and water pollution (which proved to be a small problem, easy to handle with some sewage renovations). We supported citizens in their discussions with the other stakeholders. Because the science shop is independent, and only paid by university, we were a trustworthy source. We made our explanation very personal, including tales from own family and friends, thereby showing the citizens that we understood. Thus, the citizens believed our explanation about cancer occurrence. Also our explanation that current emissions were a factor 1000 below the strictest limit, was accepted. However, since there were no data on past emissions, a cancer monitoring program was set up by the Regional Health Inspectorate. Before, the local authorities had only given the bare figures of the emissions without clear explanation (which are only the first few steps out of nine that one should take in risk communication, according to Fischhof, 1995). Our separation of the three problems opened the way for research and debate on the smells, which we calculated to be above the legal limits in this case.

We conducted some methodological work to find the right assessment frame. This was complicated because two companies were involved and they had fluctuating emissions. We listened carefully to the citizens, who mentioned “peak emissions” (occurring during product changes, which had never been investigated before). The local authorities then agreed to make a steering committee to supervise smell mitigation research. The committee included representatives of all stakeholders: local authorities with the regional Health Inspectorate and Environmental Inspectorate; both companies with their technical consultants (and lawyers at start); and the citizens assisted by two science shops (chemistry and medicine). This way, the citizens became “partners” instead of just receivers of expert results; a partnership consistent with current recommendations for risk communication (Fischhof, 1995).

Finally, a production change in the largest company and some change in waste water treatment in the other, reduced the emissions to just below the limit. However, in odour analyses there is an allowed error margin of a factor two. This meant that one could not fine the companies (they were not proven to exceed the limits), but one could also not state that there was no problem. We managed to explain this dealing with scientific uncertainty to all stakeholders. This avoided another outrage, that in our view would have been caused if the authorities would (again) claim that there “is no problem”. It also meant that no technical solutions could be implemented; one could not force the companies. Therefore, we suggested to make a 24 hours/7 days per week complaint telephone. Before, the general service phone of the city was only available from 9 to 5. Since the citizens complaint about peak-emissions and felt not taken seriously, we saw such a 24/7 phone as a solution for the mitigation of stress. Stress mainly occurs when people can not escape nor influence the source of stress. The phone, and subsequent acting of regulators, and their feedback would give citizens some control again over the situation. With the provincial authorities, this was implemented.

In an external evaluation by Neubauer (2002), all stakeholders stated that the involvement of the science shop started the communication process that finally led to solving a lot of the annoyance and fear in the neighbourhood. In fact, this could be described as a case of scientific mediation (as in conflict resolution). For the citizens, it meant that they were able to discuss on equal terms with the other stakeholders.

We put our findings forward in the technical Platform for Odour of the Dutch Association of Environmental Professionals, and managed to get the position of the citizens a prominent

place on their bi-annual national conference. Some of our technical concerns are also taken up in the long-term planning of this platform, which is an example of communicating science from citizens to research (the antenna function of science shops).

*International Developments*

The Science Shops originated in The Netherlands in the 1970s, where there now are over thirty, fully financed by the Dutch Universities. Publications on science shops by Ades in Nature in 1979, and Dickson in Science in 1984, and others, triggered a lot of attention abroad. The method was imported and adapted to many other countries. A publication by Sclove (1995) in the Chronicle of Higher Education linked the European developments to those of the Community Based Research Centres in the United States. The Dutch started an active export of their method in 1998, when their Ministry of Foreign Affairs funded the implementation at Romanian Universities. Since 2000, over 30 Community-University Research Alliances were started in Canada, based on the Dutch example, but adapted to the Canadian context. They are funded by the Canadian Research Councils.

Recent EU support has delivered documentation on science shops (the *SCIPAS*-reports and the *InterActs* reports, www.scienceshops.org). Science shops across Europe got to know each other and their network, "Living-Knowledge" is constantly enlarging. They now produce their own Journal, have an active e-mail discussion list and have piloted with international co-operation projects. Two international conferences were held to exchange ideas and experiences (Louvain 2001 and Seville 2005). The current EU funded projects ISSNET and TRAMS bring together experienced and starting science shops. In 2005, there are "Dutch model" science shops active in The Netherlands, Denmark, Norway, Germany, Austria, United Kingdom, Belgium, France, Spain, Romania, Canada, United States, Australia, Malaysia and South Korea, and initiatives to start them in Iceland, Latvia, Estonia, Greece, Turkey and Japan. Despite working regionally, there are enough shared issues.

**EVALUATION**

European Union support has allowed science shops to network and exchange information. The Dutch science shop model has proven to be portable, also to quite different contexts. However, there is no single 'best-way' to operate a science shop; local circumstances play a large role. Mulder et al (2001) demonstrate that the active support of four actors is necessary:

- Clients (societal demand for research support)
- Scientists (a supply or source of research support, e.g., students that can obtain credits or research staff that is allowed to spend time)
- Institutions (a host or supportive structure, such as university)
- Science shop staff (paid individuals doing the mediation work)

Clearly, the four actors listed above exist within specific historic socio-political, cultural and scientific environments or contexts, which means that they can differ in time and place. By studying the situation with regards to these four actors in any situation (e.g. in a country were there are no science shops yet), one can find the best format to start a science shop there.

If one of the four actors is not able to participate, initiatives will fail. In the mid 80s in France there were 16 science shops, but they could not make use of research potential of students. Also, civil society had too high expectations of science and was not willing to wait for longer research. Moreover, staff had to divide time between doing projects and raising funds. The science shops then disappeared from France. In Romania, civil society was not as strongly organised as the Dutch, but clients did come from some NGOs and non-profit institutes, and from small business and local authorities as well. Scientists were available and students were allowed to do projects inside their curriculum. NGOs were supported in obtaining funds as well. Here the introduction was successful. In France, the Ecole Normale Supérieure Cachan

started a novel “Boutique des Sciences” in 2003, involving both students and staff. These are now working on projects, giving good hope for a successful re-introduction in France.
The four actors involved also clearly show weaknesses of science shops in their current setting. If society is not well organised, or public awareness is low, a lot of emphasis has to be put on soliciting new research requests. Even though also in this case scientists engage the public and strive for partnership, a dominant role for science in finding research topics could occur. If scientists are not able to work on science shop projects, the supply of knowledge stops. Currently, academic tenure criteria consist of peer reviewed articles, with only minor attention towards teaching and none relating towards outreach. Only when the research project is part of the curriculum (part of a practical period, course or a thesis), students and staff can work on it without additional cost. Working with students also means in some cases delay because of (rigid) study programs (depending on the country). Even though on average students do good work, some of them do not score well and their results can not be published (unless there is staff time for editing). Not all scientific research institutions favour science shops. If one is lucky, university pays a lot of attention to their “third mission”, and sees science shops as a way for good regional image, social awareness of students, and interesting research themes. If the institute focuses on large, basic research projects, there is a big problem, that could only be solved by allocating separate, external funding sources for science shop projects. Finally, also science shop staff need to have a lot of additional skills, next to an overview on a scientific discipline, such as communication and management skills.

The EU mentions the restoration of trust of citizens in science as one of the reasons for supporting the science shops. They also mention raising public awareness and sciences awareness, and the fact that the themes of research fit well within Europe’s social ideals. On regional scales we can see this functioning. The EU also hopes to create shorter lines from civil society to European research agendas (Gerold, 2001). On a local scale, there are examples (as described above) of a good communication between citizens and research, giving citizens some upstream involvement on research planning. This route towards influence on European Research Policy is still very long. On a small scale, however, the Science and Society Program of the European Commission is paving this way.

**DISCUSSION**

Science shops play a special role in interactive science communication. They interact with citizens to articulate problems and potential research support, and make sure that research results are fit into the right context and presented in a useable way. This clearly is a two-way approach in science communication, raising both public awareness of science and scientists awareness of the public. Science shops can have a special, trusted position in risk communication processes, were they can help making the public a partner. They understand both the expert and the public, are independent and can act as facilitator.
Science Shop projects are mostly done on a regional scale. Even though of course they reflect on their own work, scientists involved do not have the task (nor the time) to describe their own activities on a meta-level in (scientific) papers. To describe the interesting and valuable communication processes that occur during science shop projects, work by Communication Scientists and/or scientists involved in Science and Technology Studies will be required.
Some interaction among science shops and professionals and researchers in science communication are now starting. The EC funded project CIPAST includes Excite (the network of Science Centres) and the science shop network Living Knowledge (represented by Wissenschaftsladen Bonn). In the universities of Groningen and Utrecht, science shops teach classes on research for society and on risk communication. We feel that this interaction

between science shops and those involved in other forms of science communication is very fruitful and should be strengthened.

## CONCLUSION

Science shops combine all three missions of university: education, research and outreach. They have an impact on scientific research (finding interesting research topics, raising sciences awareness of the public), education (giving valuable skills as communication and project work, raising social awareness of students, curriculum reform) and on civil society (media attention, policy influence, in general empowering civil organisations to better shape their own living environment). The science shop model is flexible enough to be applied in different contexts, provided there is a way to unlock demand and supply, and have a host institute and staff. It would be good to have overviews (studies) on the situation in countries were no science shops have been identified yet.
Science shops have a role in science communication, especially from the democratic motive. They take the science communication role of universities from the traditional PR office (science communication for cultural reasons; trying to raise public acceptance of science) to a more interactive form, without becoming an instrument in commercial knowledge transfer (science communication from an economic motive) for which many facilities and subsidies already exist. Science shops demonstrate partnerships of science and society. The many small steps that are made in regional projects make a big step from the deficit model in science communication; citizens are given some upstream involvement in science. Science shops implement article 27(1) of the United Declaration of Human Rights: *Everyone has the right to... ...share in scientific advancement and its benefits*. The work of science shops should be studied more extensively by researchers in science communication, as a good model for interactive science communication. This would strengthen and improve its impact.

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