FROM CONTENTS TO CONTEXT: CURRENT STATUS, CLASSIFICATION, AND PERSPECTIVE OF SCIENCE COMMUNICATION IN JAPAN (1)

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Abstract

Science Communication (SC) is both a critical and trendy field now bandwagonin Japan and other developed countries. Possible reasons for the increasing importance of SC include the emergence of a class of highly educated individuals and the perceived conflict between the value systems of science and daily life. SC is a creative process that encourages clear communication between science and the experiences of daily life, rather than the mere conveyance of scientific results. It is not enough to convey the "content" of scientific and technological results. It is necessary to explain and communicate the common "context" of science and daily experience. Café Scientifique is an effective trial effort to create such common context, as the Cafés create a discussion space in which scientists and laypersons interact. Our field research demonstrated that Cafés in the UK and France function in this way. However, such Cafés in Japan have sometimes operated differently. We presume this is a consequence of Japan's cultural history. Since the late 19th century, we have introduced Western science into our society, but we have only been exposed to the products of scientific activity from outside of our society without the background, context and process surrounding such science. This means that we have not shared the context of scientific knowledge acquisition. Such a condition is commonly experienced by non-Western countries, suggesting a new perspective on the science-society relationship.

Keywords: Science communication, Café Scientifique, Contents, Context, Cross-cultural communication

1. Introduction

Science Communication (hereafter "SC") has been a popular trend in Japan over the last five years(2). The *Annual Report of Promotion of Science and Technology 2006* (the so called *Science & Technology White Paper* [1]) spent the whole of Part I analyzing the relationship between science and society, with Chapter 3 focusing especially on "Communication with Society." Following this publication, increased research funds became available for SC and related areas from government sources(3).

Similar trends have been seen in other countries. SC itself originated in the UK and other English speaking countries in the 1980s [2], then spread widely to Europe and East Asian Countries including South Korea, Taiwan, and Japan. That the 2006 PCST conference was held in Seoul is a sign of the worldwide acceptance of this movement.

This paper investigates "What is SC, and what should it be?" by investigating the historical roots of SC. The importance of SC has been widely accepted, but there is not yet widespread agreement on what should be communicated by SC. Van der Auweraert [3] presented an excellent model, dubbed the "Science Communication Escalator" model. This was modified from the "Risk Management Escalator," to add the SC perspective. She divided scientific knowledge into four stages: simple, complex, uncertain and ambiguous. Each stage needs its own suitable expression of SC. For example, the Public Understanding of Science (PUS) and Public Awareness of Science (PAS) match the "simple" and "complex" stages of scientific knowledge, requiring only straightforward popularization through one-way communication. The audience can passively receive this knowledge. The Public Engagement of Science (PES) and Public Participation in Science (PPS), including Science Shop and CBPR (Community Based Participatory Research), correspond to the "uncertain" and "ambiguous" state of knowledge, which require discussion and decision making. Consensus Conference and Scenario Workshop can be viewed as interactive and ambiguous, because it deals with the interaction of several different value systems and norms.

This "escalator" model provides a clear and useful perspective on SC, but we do not accept whole of Van der Auweraert's [3] arguments. Her model is too linear. Under the escalator model, the gap between the viewpoints of science and daily life would diminish until the border between scientists and ordinary citizens vanishes. This is not the goal of SC. The ordinary perspectives of both science and daily life should coexist, with each maintaining its cultural norm. Our goal is for harmonious interactions between a plurality of cultures, not a single uniform culture (Figure 1).

Thus, SC can be viewed as communication between different cultures, an activity that requires each culture to share and understand different contexts and norms. The Science Communication Escalator of Van der Auweraert [3] places too much emphasis on the contents that are to be communicated. We argue for a wider perspective, focusing on what should *not* be on the escalator. SC should create a common context for both scientists and public, thus, the science communicator is *not* a translator, but instead is the creator of common ground between the two cultures.

Special fields of knowledge are required to share or create the common context that the two cultures can share. When we translate the content of scientific knowledge, we merely need to analyze information. However, we need the tools to design space, community and communication to achieve a common societal context. Such tools and concepts have been gathered and labeled "tacit knowledge" [4]. The Chinese cultural arena offers the concept of "feng-shui," which can be regarded as a method of arranging complex fields.

This paper takes the first steps to create a "Feng-Shui of SC," or design of contexts. We treat Café Scientifique as one of the activities to facilitate such a "field," and report on its current status and issues in the next section. We then discuss its properties compared with communication via internet, and finally we consider how the cultural and historical background of Japan relates to SC.

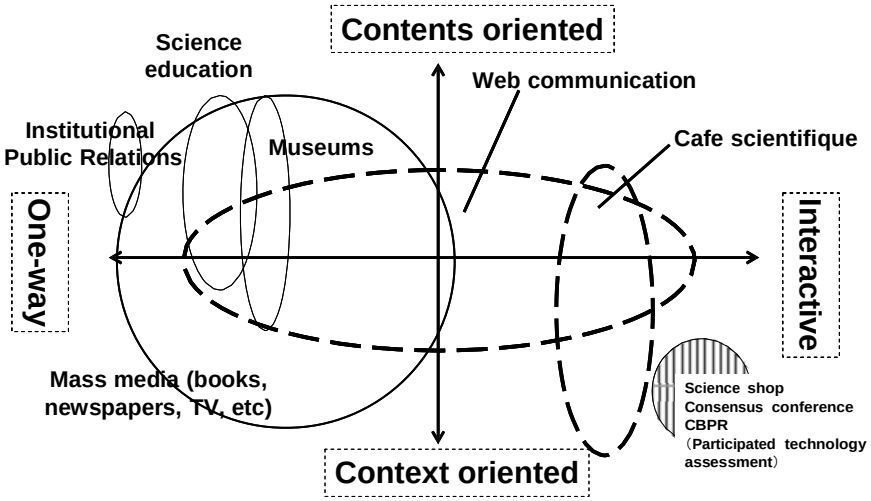

Figure 1. Classification of the methods of science communication. The horizontal axis represents whether the flow of information is one-way, from scientists to laypersons, or interactive. The vertical axis represents whether a method focuses on content or context. Traditional forms of interaction such as mass media, museums, etc. (shown as open circles in the figure) transmit content-oriented information in one direction, from scientist to layperson. In contrast, newly developed interaction methods such as science shop and CBPR (indicated by the dashed circle at the bottom right of the diagram) emphasize interactivity and the context of information. This figure shows the existence of a "large gap" between these methods, and the need to bridge them. Café Scientifique and science communication via internet (displayed as dotted ovals in the middle of the diagram) are candidates for that purpose.

2. Café Scientifique

2.1 Café Scientifique in the UK

In 1998, former TV producer Dancan Dullas started Café Scientifique in Leeds, UK. He realized the importance of viewing science from outside of the scientific community, and adapted the idea from the Café Philosophique in France. Café Sci attracted tremendous attention from the public and the media. Similar Cafés rushed to follow the model in Nottingham (1999), New Castle (2000), and Oxford (2000). By 2005, more than 40 cities have chosen to participate. The Millennium Fund and Welcome Trust supported these Cafés financially.

One of the authors (E.S.) carried out field surveys of Café Sci in 2004 and 2005. She visited Cafés at Oxford, Settle, Liverpool, Nottingham and Leeds, to interview organizers and participants. Table 1 summarizes the results of her surveys. The following are the key elements leading to the success of Café Sci (see ref. [5] for details):

1. *Simplicity*. The planning and management requirements of Café Sci are minimal. The program is inexpensive and requires little publicity. Amateur efforts and hand-made visual aids are sufficient and effective in the context of the Café. This simplicity allows the Café to maintain independence and neutrality, avoiding political bias. Many Cafés do not need to depend on outside financial resources. Raising small donations during or after the Café is often sufficient to cover management and transportation expenses for the speaker. One of the managers of the Café Sci in Nottingham is the owner of the Café itself, and he emphasizes the importance of financial independence to remain politically neutral. The Nottingham Café Sci has contributed to the success of the hosting Café, as more guests attended the Monday night meetings than before the launch of Café Sci.

2. *Facilitating discussion*. The emphasis of the Café is discussion, rather than a scientist's speech. Thus, tips are provided to facilitators to encourage open discussion by the audience, such as having a pause of 10 or 15 min between the speech and the discussion, or banning the use of PCs.

3. *Fresh topics*. Dullas (personal communication) stated that the choice of topic is the single most important element leading to success. Even if the speaker's presentation is poor, a suitable choice of topic can still lead to stimulating discussion. It should be "controversial," "entertaining," "authoritative," "concise," "worthy of in-depth investigation", and "intellectually stimulating"[6]. Café Sci is not a place to receive knowledge, but to engage in a process of discussion and discovery.

4. *Openness*. Everyone participates in the debate. The Oxford Café's flyer reads: "No background in science required; the Café is open to everyone."

5. *Benefit to audiences*. Several participants replied the reason for attending is that the discussion is stimulating, fun to think about or just that the participation itself provides an excellent social activity for the evening.

6. *Benefit to speakers*. Scientists also enjoy the opportunity to communicate with the public. They learn better the perspective of non-scientists and improve their communication skills with laypersons.

Table 1. Features of Cafés Scientifique in the UK.

	Oxford	Settle	Liverpool	Nottingham	Leeds
Frequency	second Tue., every month	irregular, once a month	third Tue., every month	every Mon. (incl. 'Café Culturel')	every Mon.
Hours	19:00-20:30	19:30(or 20:00)-22:00	18:00-c.19:40	20:00-22:00	20:00-21:30
Place	CAFFÉ NERO in Blackwell's Main Bookshop	Poppies Tea room	Everyman Café in Blackwell's Bookshop (at the U of Liverpool campus)	Wax Bar	Underground of the bar, The Old Police Station
No. of attendants*	65 (20s to 70s, half women)	23 (many elderly people, 10 women)	75 (more than half were university students)	27 (7 women, many in their 40s or older)	50 (15 women)
Fee	free	previous ticketing, £4.5	free	free	free
Management	local university professors, volunteers	local people (4 friends)	Ph.D. candidate (psychology) and assistant (math)	manager of the bar and his 8 friends	former TV producer

Fund raising	none (only help from bookstore)	Local Council of Yorkshire	planning to apply to university	never	none
Remark	many attendants have academic backgrounds; collaboration with bookstore	rooting into original local community; Café Sci developed into larger Christmas lecture	beer-mat as question form; launching with the assistance from the Café Sci Network	successful example as business model; topics include other areas than natural sciences	the oldest Café Sci in the UK

* From the research of E.S.

7. *Community*. Each Café Sci is strongly influenced by its location. In Oxford and Liverpool, a university is close to the Café, causing higher attendance by students and professors. The atmosphere of the Café at Settle was more relaxed. The café is gathering place for the local community and was a hub of social interaction even in the days before Café Sci. The Settle Café Sci takes advantage of the existing social structure. As a note, the relationship between the local community and the Café Sci should be systematically studied.

8. *Adaptability*. The Café does not have a fixed format, style or rules. The concept is quite simple and open to interpretation. This allows different Cafés to adapt to local conditions and situations, taking a form that fits local needs. This is one of the reasons why Café Sci spread so widely within such a short period.

2.2 Café Scientifique in other countries (except Japan)

In France, radio journalist Marie-Odile Monchicourt started "Bar des Science"[7]. It is more casual and open than Café Sci in the UK. French Cafés usually debate scientific topics without the first hearing a scientist speak. They avoid the talk, concerned that it might frame or influence the direction of the discussion that would follow. Multiple specialists are invited to join in the discussion, representing the diversity of opinions among experts. A similar French event, called "Café Science et Citoyen," is organized by CNRS.

Café Sci in Denmark deals with more diverse topics. Rather than limiting itself to topics within natural science, the Danish Café Sci addresses topics that bridge science, journalism, art, and the humanities (*The Science Café: Science, Art and Culture*, 2004).

In South Korea, the first Café Sci was held in August of 2005, and one of the authors (Emi Sonoda) participated. It was co-sponsored by the Korean Science and Engineering Foundation (KOSEF) and the British Council in Korea. The audiences were required to speak English, and English was spoken during the Café without translation. These conditions largely restricted participation to university students and academics. As Mr. Sook-Kyoung Cho remarked, the aim of this Café was clearly to enlighten younger highbrows. This is totally different from the founding precepts of Café Sci in the UK and France, which are open to public. The South Korean example demonstrates the flexibility and plasticity of Café Sci to the local cultures.

2.3 Café Scientifique in Japan

2.3.1 Café Scientifique Tokyo

Several Cafés Sci have recently been implemented in Japan. One of these is the Café that is organized and planned by our laboratory in conjunction with the National Museum of Emerging Science and Innovation (MIRAIKAN), incorporating the efforts of information designers and programmers to encourage communication among real and virtual communities [8].

In this section we focus on the challenges posed by Café Scientifique Tokyo, a voluntary group launched in June, 2004. Its aim is the creation of a model case of Café Sci, a unique goal, unlike other Cafés in Japan. The members consist of researchers and university students who carried out the first Japanese research into Café Sci in Japan around 2002. Many of them were the members of the Research Center for Technology and Society at the National Institute of Advanced Industrial Science and Technology (AIST). The research was reported in *Science & Technology White Paper 2006* [1] causing the rapid spread of Cafés in Japan.

Café Scientifique Tokyo's strategy is an accurate copy of Café Sci in Europe. Despite several differences of both culture and society, this is a first step toward a more suitable style of Japanese Café. The Café is located in Shimokitazawa, Tokyo, a trendy area frequented by young Tokyo residents. The Café is attached to a gallery for young artists and old movies are always running in the background. Science is now a part of the culture of this Café. A total of four events have been held through March, 2006. The speakers were friends of the organizers. The talks started at 19:30 (except the first event, which started at 18:30) on weekdays, irregularly. Advertising and promotional efforts focused on the local area, Shimokitazawa. No prior subscription was needed, and anyone could attend.

The event was held in the same manner as Café Sci in the UK. The room in which the event was held was small, so 20 people almost fill the space. This intimacy allowed speakers to present without microphones or slides, creating a casual atmosphere and encouraging active discussion. The text on the invitations and flyers emphasized that the Café was open to anyone and that no special knowledge was required. Questionnaires revealed many positive responses to the event, although the sample size was still small. Discussions were very active, but sometimes seemed more like a Q&A session with the speaker, than a discussion among participants. We still need to hold more trials and improve our methodology.


Figure 2. Scenes of Café Scientifique in Shimokitazawa, Tokyo, organized by a group of volunteers. (April 5, 2005 [left], November 29, 2005 [right], photos by Emi Sonoda).

2.3.2 Comparison of Café Sci between Japan and UK

Cafés Sci in the UK and France function as venues for discussing topics and chatting with scientists. Both the speakers and participants interact on an equal basis. Café Sci Tokyo tries to reproduce such styles of interaction as well as possible. However, other Cafés in Japan typically preferred a lecture-style event set in a casual atmosphere. Some took place at larger halls or science museums, rather than cafés. This approach may facilitate scientific communication, but does not encourage discussion among equals.

This difference may be the result of a lack of Café Culture in Japan. By contrast, chatting in cafés is part of modern culture in Western Europe [9]. It is customary for Europeans to enjoy chatting at cafés, and Café Sci introduced science as a topic of discussion into "this culture." We Japanese do not have a custom of having coffee or black tea and chatting in a café. Japanese tea exists, of course, but Japanese citizens typically interacted in other places, usually where alcohol is served [10]. Café Sci was introduced into Japan as a new tool to eliminate science phobia. The form of the café was introduced into the science-society relationship in Japan. This is the complete opposite of the situation in the UK, where the science was introduced to café culture.

We do not deny the importance of casual lectures, and agree that cafés may even be a suitable place for such. We suppose, however, that the potential of Café Sci is not limited to lecture-style educational discourse. It can provide a foundation for the culture of science and to broaden the minds of scientists.

3. Historical Perspective of Science Communication in Japan

3.1 Yukichi Fukuzawa and His Challenge

The previous section surveys Café Sci as a method of creating common contexts shared by the spheres of science and of daily life. This section examines the historical perspective and discusses the background of SC in Japan. We have two goals: first, contextualizing current efforts such as Café Sci into a wider historical perspective, and second, presenting a case for the acceptance (or refusal) of science in a non-Western country. We believe it is important to consider science from a more global perspective.

The first science communicator in Japan might be Yukichi Fukuzawa (1835-1901), a philosopher, sociologist, and influential leader in the early Meiji Era. Japan experienced the Meiji Restoration in 1868, a great reformation of the structure of political governance. The Meiji Restoration marked the beginnings of modernization in Japan, not only in a political sense, but also of society and culture. Fukuzawa was a typical liberal modernist, and his opinions greatly influenced the newly modernized society of Japan. He founded Keio University (1868) and wrote many books to spread his concepts of modernism and liberalism.

Interestingly, one of his earliest publications was on natural science. He published *KINMOU KYUURI ZUKAI (An Illustrated Introduction of Physics)* in 1869 (Meiji 1), just after the Meiji Restoration [11]. He believed that rational scientific knowledge is necessary to create a modern nation, and for success in the global political landscape

among developed Western countries [12]. *KINMOU KYUURI ZUKAI* ("*ZUKAI*," hereafter) explained the basics of physics including thermodynamics, meteorology, astronomy, and mechanics with plenty of illustrations. Fukuzawa emphasized the importance of rational thinking and referred to everyday items to explain basic concepts of physical science. The former may be just the expression of rather simple modernist enlightenment thought, but the latter suggests Fukuzawa's belief that science has (or, should have) a strong connection with daily life. He used, for example, a traditional Japanese attraction for the explanation of siphon effect, an open hearth for thermal expansion, firearms for the law of conservation of energy. His lively and fascinating style clearly displays Fukuzawa's talent as a science communicator. He tried to create a new context shared by both Japanese traditional society and newly introduced Western science.

3.2 Erwin von Bälz: a Fundamental Criticism to Science in Japan

Fukuzawa's efforts did not come to fruition until the end of the 19th century. Modern Western science did not integrate with Japanese culture. German physician Erwin Otto Eduard von Bälz (1849-1927) was clear in his criticism of such. Von Bälz, a German-born medical doctor, came to Japan to teach medicine at the University of Tokyo's School of Medicine in 1876 and stayed until 1902 as a foreign professor. He was one of the founding fathers of the medical educational system in Japan, and the most influential figure among them. He married a Japanese woman and had a son. The Meiji Japanese government hired several university professors from foreign countries [13]. These foreign professors were called "*OYATOI*" which means "the hired" in Japanese. Both now and at the time, von Bälz was one of the most famous and influential of more than three thousands *OYATOIS*. At a celebration honoring the twenty-five years of his stay in Japan, held at the Koishikawa Botanical Garden of the University of Tokyo on November 22, 1901, von Bälz addressed the attendees. In his speech, he commented on the status of science in Japan as follows:

> I have the feeling that in Japan the origin and the nature of science is largely misunderstood. Science is seen as a machine that annually will produce a certain amount of work and also as one that can simply move to another location to continue operating there. This is a mistake! Western science is not a machine but rather an organism for whose development as for all other organisms certain climatic conditions and a certain atmosphere are necessary….
> Honored guests! For the last thirty years you too have had many among you who possessed this spirit. Western countries sent you teachers who eagerly sought to transplant this spirit and to embody it in the Japanese people. Their mission, however, was often misunderstood. Originally, they intended to be people who were to nurture the tree of knowledge and they proceeded accordingly, but often they were treated as if their function was to sell the fruits of science piecemeal. They wanted to sow the seedbed and hoped that from proper care would carry ever new and ever more beautiful fruit. Yet in Japan only the products of today's science were wanted. It was felt to be sufficient simply to accept the latest results and not to bother to try to understand the spirit that brought them forth. (pp.171-173, ref [14])

His point was that Japanese society introduced only the results of Western science without introducing its fundamentals. As such, von Bälz's words are often cited by authors criticizing the status of science in Japan. It seems to be "Bälz's Spell" for scientist and engineers in Japan.

We should break that spell. It is impossible to transplant the whole system of another culture, and it *should not* be attempted. Each culture has its own approaches, and simply imitating other cultures will not lead to happy consequences. Thus, non-Western countries had no option other than introduce *just* the fruits of modern Western science. East Asian countries, including Japan, have been the recipients of such, willing or not. This strategy has led, in part, to our present prosperity, especially in the field of science and technology. We have already released ourselves from Bälz's Spell, even we have not been aware of it.

3.3 Current Status of Science Communication in Japan

140 years has passed since Fukuzawa's *KINMO KYUURI ZUKAI*, but it is still not easy to evaluate the current status of SC in Japan objectively. On the positive side, funds have been budgeted for SC related projects. Moreover, some research funds granted to natural science and technology projects also obligate that project to spend a certain percent of the grant amount on communication with society, including ELSI matters. However, teaching curricula and textbooks for SC do not exist. The career path for science communicators has not been established. It is imperative that positions for science communicators be created, attached to research institutions engaged in major projects including COEs. It is necessary that scientists and engineers become aware of the importance of science communicators, and for that to occur there will need to be more cases in which science communicators contribute to projects by increasing the public's esteem for scientific work.

Despite several problems, the importance of SC is now widely accepted by Japanese society. We hope this represents the maturation of SC in Japan. Two impressive examples are provided by paperbacks written by science journalists and published in 2005. The first is *Seven Million Years of Human Evolution* [15] by Makoto Mitsui. The

author is a science journalist for *Yomiuri Shinbun*, one of the largest newspapers in Japan. Mitsui reviews the frontiers of human evolutionary studies with reference to social issues of paleoanthropology, including classification and its approach to unsolved issues. The core of this book is enlightened philosophy in the style of Yukichi Fukuzawa, but the social features of scientific activities are properly focused.

The other novel suggesting the maturation of SC in Japan is *INOCHI (The Life): Does Life Science Have Daily Words?* [16], written by Hazuki Saisho, a freelance writer. This book presented twelve interviews of life scientists, ethicists, religious scholars and so on. Hazuki asked these specialists frank questions focusing on the relationship between life sciences and the everyday world. Hazuki's seeming goal is to eliminate the gap of understanding between the scientists and ordinary people. Throughout the book, she struggles with these practical issues.

These two books are just recent examples of the progress made by SC in Japan. It is good that journalists are reviewing the performance entire scientific fields, trying to bridge science and daily life. These two books are symbolic of the maturation of SC in Japan. The history of science and technology in Japan has been always PUS and/or PEST. 140 years after Fukuzawa, the works of Mitsui and of Saisho are major examples of the fruit seeded by Fukuzawa.

4. Concluding Remarks

We emphasized that it is necessary to create shared context for SC to function, and have observed Cafés Scientifique as venues that can create that shared context by integrating communities. One role of the science communicator is to encourage communication between two different cultures, those of science and daily life (cf. ref [17]). This communication is not a simple translation, as we previously mentioned. Rather, it is an active process for the creation of an open-minded framework that allows for the existence of unfamiliar cultural norms. This communication is cross-cultural. While the perspective of SC as the facilitator of inter-cultural dialogue has been emphasized already (see ref [18] for an example), communication itself is not final goal. The ultimate aim is sympathy for and allowance of unfamiliar value systems. SC facilitates the assimilation of knowledge that comes from the value system of "others" into "our" value system.

For this process to succeed, we need a newer guide that is based on both the views of science and of daily life. One of the authors (O.S.) is working on projects named "Living Science," with Akifumi Ueda and his NPO "Citizen's Science Initiative Japan," which reconstructs the relationship between science and daily life from the viewpoint of ordinary citizens [19]. However, the theoretical framework established so far is still not satisfactory, although preliminary perspectives are in development.

We may ask the wisdom of pioneers. German philosopher Edmund Husserl (1859-1938) strongly questioned the dominance of scientific rationalism from the perspective of daily life [20]. He was aware that rapid development of the natural sciences, especially psychology and physiology, conflicted daily with human values and argued in favor of gaining a firm foothold on "der Lebenswelt." Current SC and the Living Science Project share Husserl's paradigm of bridging the gaps between science and daily life. Husserl published his work more than fifty years ago, but the essence of his work is still alive. We may get additional perspective on SC from further historical research.

SC has several faces, including studies of cultural and social systems. Science communicators must possess acute sensitivity to society's ideals while maintaining positive perspectives. We have defined SC practitioners as creators and producers, and now we would add to that paradigm the need for sensitivity to science and technology, as well for society.

Acknowledgments

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Notes

(1) Some parts of this paper are revised and cited from refs. [5] and [21], both published in Japanese.

(2) The distinction between science and technology is one of the most basic concepts in the study of science. We completely agree with this distinction, however, we use the term "science" to refer to the combined body of science and technology in this paper. The unification of S&T might be one of the most important observed trends of the 21st century.

(3) The Ministry of Education, Culture, Sports, Science and Technology of Japan started the "Program for Proposal for Science and Technology Policy" in 2001 as a part of the Special Coordination Funds for Promoting Science and Technology (SCFPST) and a total of 19 projects were launched during the three years up to 2004. During the 2005 fiscal year, a new budget for the "Communicators in Science and Technology Education Program" within the "Program for Fostering Talent in Emerging Research Fields" of SCFPST was established, then three

other centers (University of Tokyo, Hokkaido University, and Waseda University) started their own programs. Other examples of funding and projects include “New Research Initiatives for Humanities and Social Sciences” by the Japan Society for the Promotion of Science (JSPS) and the Research Institute of Science and Technology for Society (RISTEX) within the Japanese Science and Technology Agency (JST).

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