A Strategy for Scientific Research: Global Standards

Kenichi KANATANI†

† Department of Computer Science, Okayama University, Okayama 700-8530 Japan

Abstract This article points out problems that Japanese scientific researchers have for establishing themselves in this age of global competition. Typical misconceptions about the goal and means of scientific research are pointed out, and various strategies for winning international recognition are suggested, including the art of paper writing, human interactions, communications in English, and active use of the Web.

Key words scientific research, paper reviewing, art of writing, human interaction, English skill

1. What is Research?

All of you are scientific researchers, students and professors alike. But do you know what research is really? Many may think that it is an activity of finding something new, or things that are attractive to people in some way, e.g., useful, interesting, or simply beautiful. But what happens if you find such nice things? You will become famous? Or rich? Will people admire you? Will important progresses ensue?

Not at all. These things can happen *only if your results are known to other people*. If you keep the results to yourself, you make no contribution to the world. You may satisfy your personal curiosity or just feel good, but it cannot be called *research*.

In fact, research is the activity of finding something new *and* letting others know about it. Many people forget about this. You are likely to think that your research is successfully completed when something new is found. Then, you automatically expect that you will be rewarded for it: theses, fame, funding, positions, promotion, and other good things. But you cannot have these *unless other people understand your achievements and recognize their significance*. It is *your* responsibility to make that happen, and no one else's. Thus, publicizing your results is *as important as* creating them.

Some time ago, Japanese universities did not allow professors to attend conferences for presenting their work using their research grants. Yet, they were allowed to go for *listening* to others' presentations. It sounds ridiculous, since presenting something is more difficult and hence more valuable than just listening. However, the government would insist that a research grant is for *achieving* something: if listening to other people's presentations can help you achieve something, you can use it, but if you just give away something *after* you have achieved it, it is a waste of money and hence outside the purpose of the research. So, we professors all used to state the purpose of attending conferences as "obtaining relevant information for conducting my research" when asking the university for a travel permit (and of course no punishment came if you presented your paper there).

Now, it has been at last recognized that presenting a paper is an indispensable *part* of research, not something extra *after* research. So, spending research money on presentations and publications is regarded as a legitimate use of it.

When I was a graduate student, I remember an elderly assistant professor who often boasted that his research results would be recognized by future generations long after his death. He had written several internal reports, but very few of them were accepted by conferences for presentation or by journals for publication. Naturally, there was no chance of his being promoted to a higher position. Soon, he no longer bothered with all the effort, only expecting posthumous fame.

I was impressed by his confidence in himself but determined that I would establish my reputation in *this* world.

2. If Your Paper Is Not Accepted

Thus, completing your research requires your results to be recognized by other people. Today, this is mostly done by submitting papers to conferences for presentation and journals for publication. But, as you have probably experienced so many times, your paper is often rejected with severe criticisms. What should you do about this?

First and foremost, don't be shocked at rejection. You may wonder how on earth reviewers dare to reject such an evidently good finding as this: do they have personal animosity against me? But you should remember that it is a normal state. I have experienced a lot of rejections myself. Christopher Longuet-Higgins once told me that being rejected is a necessary condition for your work to be good. If your paper contains something new, it cannot be easily understood by reviewers because of the very fact that it is new. If reviewers immediately understand that, it is very likely to be either not new or easily conceivable from known facts.

A paper is rejected if it is very bad or it is very good. What to do if you are confident that the latter is the case? Resubmit it to another conference or journal? These reviewers are all fools; if this paper is read by "normal" guys, they ought to recognize the value of my paper, you may think. But forget that. Most likely, you will get more or less similar

reactions from a different review. I have a lot of experience being asked to review identical papers by different conferences and journals again and again. No matter where and how many times you submit, the paper is destined to be sent to the same group of people for review. Papers are not reviewed by randomly selected people; reviewers are carefully chosen by the editors from those who are regarded as relevant to that subject. Today, research fields are so expanded and so subdivided, very few are capable of understanding things in each subdivision.

The correct solution is to rewrite the paper. The paper was rejected because you didn't write it properly. The major cause for this was in your misconception that the paper would be read by almighty authorities. Reviewers are not authorities. They are average researchers like you and me, or *peers*, who happen to be doing something related to your work but not quite the same. If your paper contains new things, the reviewers don't know them. And it is very difficult for anyone, particularly for reviewers, to understand something new by just reading a paper of limited length for a very short time. (And remember, reviewers are just as busy as you, doing their own research and other professional duties.)

3. The Art of Writing

Whenever I write a paper, I write as if I am talking to potential reviewers, imagining that they are sitting in front of me. I write something, and I can imagine that they raise their eyebrows. So, I add explanations. I can imagine they are deep in thought. So, I give them helpful discussions. I recall my experiences of speaking to people, in private discussions, classrooms, seminar rooms, and conference halls, and their reactions to what I said. And I imagine how they would react to what I am writing as if I were speaking to them about that. The purpose of writing a paper is to convince the readers, not just to write down what you did for the record. Do not make a mistake about that.

A typical mistake is to try to include everything you did in your paper. You may think that making a paper self-contained would be a great service to potential readers who are not familiar with the subject. But before the paper reaches them, it must convince reviewers who are familiar with the subject. First things first. Concentrate on only things that are new, fully explaining how your ideas and methods are different from existing ones and why yours are better. Omit descriptions of well-known facts, even if these are essential for your results, *as long as* you think potential reviewers may know about them. The psychology of reviewing is that if reviewers see something that they know very well, they tend to take it as evidence of the author's unsophistication, dismissing the paper as obvious and failing to notice the essentials interspersed among inessentials. I have made such mistakes many times in the past. If the reviewers happened to be unfamiliar with these basics, they always demand the author add more explanations. Then, you can gratefully elaborate. It is crucial to guess the state of mind of the reviewers.

When I was a student, I was accused of cheating by another student. He said that he had been doing the same thing as had appeared in an article I had just published, and that since he had started before me and he had already known the result that I presented, he should be credited with the finding. I replied perhaps so, and there might be many others who also knew that, but that was no surprise because it was true after all; the only difference was that I presented it better than anyone else, so people understood—that was what research was all about.

But I have often found myself on the opposite side. I read many papers which presented as new findings things that I had already known. There is no sense in protesting; they explained the ideas more convincingly than I would. As long as they didn't actually steal the idea from me, being first into print is obviously important.

4. Active Communications

So, research is an activity of finding something and letting people know about it. However, what do you do if people, reviewers to be specific, don't understand that? If you have achieved something entirely new, convincing people in a paper with a limited number of pages is a very difficult matter, no matter how hard you try. If no one can understand you, what audience should you turn to for evaluation? The answer is: you should create it. Reviewers don't understand your results because they don't know about them. So, let them know about them.

Even if you are denied presentation at conferences or publication in journals, there are still plenty of means to publicize your results to future reviewers. The most basic means is personal communication. To begin with, speak to someone who you think may show interest in your results at a conference site. A conference is not simply a place for presenting your work and listening to others' work. It gives you a good opportunity to learn who is interested in what and how much they know or don't know about something. So, it should not be difficult to spot people who might be interested in your results. If they show interest, send them your papers afterward (I used to send reprints via air mail, but PDF files are such a convenience today). Researchers always welcome materials and information related to their work. Of course, you have to talk to them well, and the papers have to be written well. Everything depends on your communication skills.

A far better way than sending papers is to visit them, if you have the means and time for that. Researchers always welcome visitors for discussions and interactions. Usually, they pay for your talk and your accommodation. When I was young, I was not so busy with university duties as I am now, so I visited people after a conference abroad. Before a conference, I looked at a map and examined where people I was interested in lived and who was easily accessible from the conference site. Then, I wrote saying that I would like

to visit them before or after the conference. They always welcomed me, and I always had a good time with them. If a conference was for three or four days, I extended my stay in that country to two weeks for visits. I looked into my old records and counted the number of such visits. It totaled 51.

Nowadays, I am so busy with my responsibilities in the university that I mostly arrive on the day before the conference opening and have to leave as soon as it ends. How I miss those good old days.

But now I enjoy receiving visitors. Many people, young ones in particular, come to me in my university for discussions and interactions. I cordially host them just I was hosted when I was young. I also counted the number of such visitors. It totaled up to 47. I find that those young people who once visited me invariably become prominent scholars afterwards. Such people are those who understand my work best.

5. Where to Submit

Today, my papers are often rejected, which is no surprise, but when my papers are accepted by prominent conferences or distinguished journals, I believe in all probability those reviewers who put a high value on my paper were people who I once visited, who I worked with, or who once visited me. This is not favoritism. If they know me, they can understand my work because they know the background and my preceding work. If they have never heard of me, they have difficulty reading my papers. That is the nature of humans.

So, when you submit your papers, always choose those conferences or journals with which you think most of your acquaintances are associated, even if your topic is rather outside the main themes of the conferences and the journals. For example, if your result is a pure mathematical analysis in a general and abstract form, it is not a good idea to submit it to a conference or a journal of mathematics. If you want to do so, by all means try, but you should first get acquainted with mathematicians who can understand your work and make them your coauthors.

Suppose that after all your efforts your paper is not accepted by any conferences or journals. Is there anything to do about this? Yes, there is. If no conferences or journals are available, just *create one*. Communicate with researchers all over the world who you know have interest in that particular subject, and open a workshop yourself. Today, funding for such an activity is easier than ever before (surely easier than obtaining individual research funding). Then, collect papers and publish them in the workshop proceedings. It is not difficult to ask publishers to publish the proceedings in the form of a book. If the workshop is successful, make it a periodic event. That may lead to creation of a new journal on that subject. But more often than not, your activities will be widely recognized, and by that time your papers will easily be accepted by existing journals.

I have been involved in such activities many times in the past, and through such activities the number of people who understand each other's work has greatly increased.

6. The Language Problem

In order to complete research, you need to communicate with others well. In this respect, the biggest obstacle for us Japanese is, of course, the language, or English in particular. It is a widely known fact that English proficiency of Japanese is the worst among advanced countries; survey after survey confirms that. This has done great damage to the academic communities of Japan in the past. Often, pioneering work by Japanese was ignored because of poor English writing, and lesser works done afterwards by English speaking people were given the credit.

The matter is compounded by the fact that the role of oral communication is ever more increasing as the world is becoming smaller and smaller. Today, many conferences are held across the world on one subject, and new results are presented one after another. The results are immediately known to the rest of the world, and new developments ensue. By the time a paper is accepted and published in a journal, it is already a matter of the past. Journal papers serve only as records, no more as a source of new information. In order to keep up with the latest results, you need to get involved in the process, and communication skills are a vital prerequisite.

Thus, what one needs to do research is not only time, personnel, environment, and funding, but also language skills. And there is no quick answer to the language problem that Japanese scientists encounter. You need passion and continued efforts to improve your English.

When I was young, I tried to find time to read English newspapers and journals as often as possible and to speak English at every possible opportunity in Japan and abroad. I made use of all possible media—radio, TV, phonosheets, records, and audio tapes (video tapes, CD, and DVD were not available those days). It is when I passed the age of 40 that I found myself capable of communication in English to a tolerable degree.

Most university graduates lament being unable to speak English after learning it for as long as 10 years (starting at age 13 in junior high school). And they blame either their incompetence or the Japanese English education system for that. This may give them a good excuse for abandoning their efforts, but they are wrong. It takes about 30 years' effort to really learn English, according to my personal experiences.

7. Who Are Fit to be Researchers?

According to my experiences, many students in Japan who go on to Ph.D. courses and then to academia are doing so just to avoid the corporate life. They say that they hate the close human interactions and communications required in corporations. They prefer a peaceful solitary life in seclusion dealing with things, avoiding human interactions as much as possible except for occasional teaching duties. No one is more unfit to be researchers than they.

I once interviewed a former graduate who wanted to enroll in a Ph.D. course after working in a company for several years. He confessed that he was tired of corporate life and wanted to be free from bothersome human relationships, concentrating on scientific research. He was surprised when I asked him what is the good of finding new things by doing research. To him, the activity of finding new things in itself was of unconditional value, resulting in automatic reward for his noble act of enhancing the knowledge of human beings.

I pointed out that contributions to the world can result only through human interactions and that your results would not be appreciated by others (not to mention by your colleagues, supervisors, and superiors) unless you yourself convince them. So, a researcher is a manufacturer and a salesman combined. Sooner or later, you will also have to play the role of administrator and financier.

Thus, the Japanese academic communities in large part consist of unfit people, and this has caused a heavy loss in competition with other countries. In the U.S.A., Ph.D. candidates are mostly foreign students. To them, an academic career is practically the only way left for them to fight for establishing their life there, and they believe they are fit for it. Their passion and enthusiasm are reflected in the way they present their work, orally and in writing. Most of them have the language problem just as the Japanese do, but they are well compensated with their efforts.

At international conferences, I frequently see Japanese speakers unable to answer questions from the floor, either because they cannot understand the meaning of the questions in the first place, or because they don't know how to express the replies in English. They often apologize, saying "I am sorry I am not good at English." This is typical of Japanese.

There are a lot of foreign students in other countries who have very poor English skills, of course. But they make much more effort than Japanese, because they know that they would not be able to establish themselves as scientists without English skills. So, few would apologize at conferences; that would be self-denial. They would try to say something, however formidable a task that might seem for them. In contrast, Japanese researchers have long enjoyed a comfortable life in Japan, such a big and developed country, where they are highly esteemed for their scientific studies without uttering a single word in English.

Now has come the age of international competition to be conducted by a global standard. The age-old mentality of surveying foreign literature, importing theories from abroad, applying them into practice, and presenting the results within Japan (and exporting and marketing the end commodities all over the world, which has made Japan such an economic giant) has to be stopped. Scientists and engineers all over the world have to compete with each other on an equal footing and using the same standards (and using the same language). Those who are not ready for this are unfit and should not be researchers.

8. Exploiting the Web

Today the Web provides a powerful tool for international communications. So, why not exploit it to a maximum degree? Many people just post their publication list together with links to downloadable files with the expectation that their achievement will induce the attention, respect, and admiration of others. But I would say that this is passive and self-centered thinking. Just think—people do not browse for admiring others; they search for information that can help *them* do *their* research. Therefore, in order to publicize your achievements, it is much more effective to place something useful for those information seekers.

The best way for that is place the program codes that you used to produce your results online. I placed many programs my colleagues and I wrote on my Web page. I received a lot of thankful e-mails from many young people who used our programs in their Ph.D. theses and application systems they built. Also, I have seen many presentations and papers by others who compared their methods with ours.

If you want to propose a new method, you need to compare it with existing ones. In the past, we wrote programs from scratch by reading descriptions given in others' papers. But this is more and more difficult as the technology develops rapidly. Due to the limited pages of conference and journal papers, it is almost impossible to understand the authors' programs in their entirety. As a result, those methods whose source codes are not publicly available are not compared. Thus, publicly offering source codes is vital for your papers to be cited.

This idea is not just limited to programs. It is also effective to provide data (pictures, video images, sensor data, and synthetic data for simulation), since comparison of methods should ideally be done with the same data in the same condition as others. Today, there are even groups of researchers who are entirely devoted to creating standardized data sets, which is known as *benchmarking*. Today, I often see papers which contain pictures we used for our experiments and placed on our Web site afterwards. Of course our papers are cited as references.

The secret of advertisement is to help others. If you help others, they will help you.

Kenichi Kanatani received his M.S. and Ph.D. in applied mathematics from the University of Tokyo in 1974 and 1979, respectively. After serving as Professor of computer science at Gunma University, Gunma, Japan, he is currently Professor of computer science at Okayama University, Okayama, Japan. He was a visiting researcher at the University of Maryland, U.S.A., the University of Copenhagen, Denmark, the University of Oxford, U.K., and INIRA at Rhone Alpes, France. He is the author of *Group-Theoretical Methods in Image Understanding* (Springer, 1990), *Geometric Computation for Machine Vision* (Oxford, 1993) and *Statistical Optimization for Geometric Computation: Theory and Practice* (Elsevier, 1996). He is an IEEE Fellow.