Make the best use of your serendipity by inspiring your audience

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Abstract

Although the ability to make the best use of accidental discoveries, or serendipity, is one of the most important factors in making great leaps in research and development, such breakthroughs are accomplished only after unexpected opportunities have occurred. Most of our senior colleagues have told us that to experience such opportunities we should maintain a steady interest in our goals and undertake experiments with our own hands. In this paper, the author presents another viewpoint. Always write and present your work with a view to inspiring others to react. Some of the resulting reactions may provide you with unexpected opportunities. This idea is derived from a three-way classification of the unexpected chances that occurred during my fiber fuse research including my self-archiving activity that led to unexpected responses via the Internet.
Keywords: serendipity, optical fiber, fiber fuse, presentation, self-archiving

1 Introduction

It was late March in 2007 when I gave a talk at a symposium on serendipity held as part of the annual meeting of the Japan Society of Applied Physics. Five researchers were invited to speak under the title of "Serendipity-driven researches on disordered-materials for photoelectronics" †. It was very exciting to learn some interesting lessons from the detailed stories behind the speaker's accomplishments.

The other speakers were older than me and their stories had a greater impact. On the other hand, I think I was able to introduce some recent events with freshness and reality. The common lesson derived from the discussion was to persevere with our own experiments. In addition, I provided another point of view, namely that we should write and present our work to inspire others to react.

In this article, I try to provide a detailed commentary on this viewpoint. In Section 2, I briefly describe two serendipitous episodes that occurred during my fiber fuse research. In Section 3, I discuss a three-way classification of unexpected chances based on these episodes. In Section 4, I present a sequel to Section 2 in which spontaneous responses were induced by my self-archived materials.

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2 A chain of chances in my fiber fuse research

2.1 Episode 1

A salesman visited to my office without an appointment. He pointed to a photograph in my research poster and said,

"Please try our brand new camera. I'm sure it will help you!"

He was proposing a demonstration of his ultra-high speed video camera. However, it reminded me of another more interesting subject. I began to prepare for the demonstration right away.

The subject was the light-induced destruction of optical fibers called fiber fuse (see Fig. 1)[3]. It was first reported as a strange phenomenon in 1987 [4] and has turned out to be a real threat as a result of recent progress on laser technology. Although the available laser power has increased since the turn of the century, this phenomenon presents a stumbling block with respect to high power light delivery through optical fibers. In addition, this destruction proceeds slowly along the fiber length. Most people would be interested in seeing bright spot moving silently at about 1 m per second (see YouTube movie at http://www.youtube.com/Tokyo1406).

One day in August 2004, we started an experiment using a special video camera that operates at 120,000 frames per second. Despite the limited time and conditions, we accidentally succeeded in obtaining clear images of fiber fuse propagation. Immediately I wrote a paper instead of taking a summer vacation so that I could submit it as a post-deadline paper to an international conference only three weeks away. I went to Stockholm without any confidence and so was pleasantly surprised to find it had been accepted [5].

On the day of the presentation, after answering severe questions about my insufficiently prepared talk, I saw one of the questioners waiting for me outside the room. He was a Russian professor, and he said,

"Your paper did not receive high marks from the other members of the selection committee, but I insisted it be adopted."

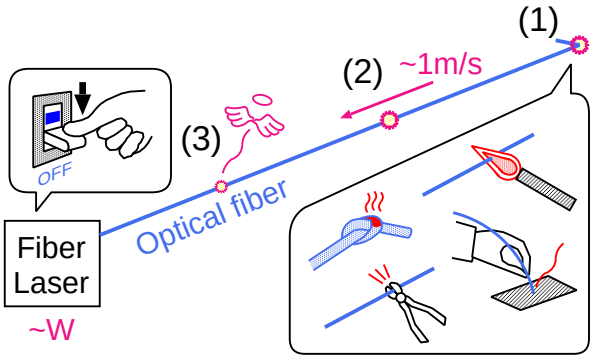

Figure 1: Illustration showing (1) the ignition, (2) the propagation, and (3) the termination of a fiber fuse. A fiber fuse is initiated by the local heating of a single-mode optical fiber made of silica glass delivering a few watts of light, which generates an optical discharge running along the fiber to the light source at about 1 m/s. This is due to the temperature dependence of the light absorbance of silica glass, which increases rapidly beyond 1000 °C [1] and causes light-heat conversion that generates an optical discharge of several thousands of K [2]. This results in the catastrophic destruction of the core region and the formation of periodic voids (see Fig. 2) and the damaged fiber no longer transports light. Researchers in industry have been developing technologies for avoiding and suppressing this phenomenon.

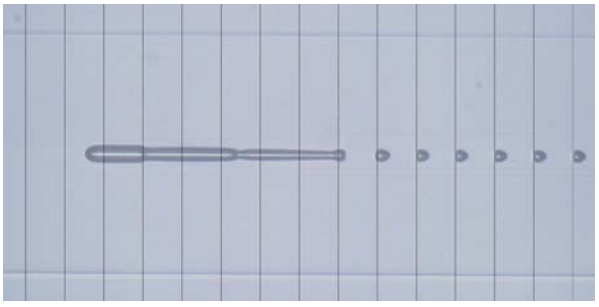

Figure 2: An optical micrograph showing the damage generated by 1480nm 7.0 W laser light. The distance between the two horizontal lines corresponds to the diameter of the optical fiber, 125 μm. The vertical lines are added to provide a scale with an interval of 20 μm. The light entered from the left.

His group was also trying to capture images of fiber fuse propagation. Although he could have

ignored my submission, in a spirit of fairness he gave way to a young researcher from Japan. Twenty days later, his group published their results at a domestic workshop [6].

After that, I contributed this episode, written in Japanese, to the newsletter of an industrial association. Then, the salesman submitted this article to the president of his company. The president's response was to provide me with continuing support. In addition, I sent a reprint to a professor of my acquaintance. Later, he gave me the chance to talk at the symposium on serendipity that I mentioned above.

2.2 Episode 2

It was then that I started to study fiber fuse. One day, I came up with an interesting hypothesis clarified an unsolved issue about fiber fuses, which leaves periodic voids in the core region of optical fibers as shown in the right half of Fig. 2. That question was why are these voids bullet shaped? The chance discovery occurred when I unintentionally viewed a microscope image of a fiber fuse termination point (see left half of Fig. 2) prepared by switching off the pump laser as shown in Fig. 1(3). I was convinced that it was a frame of a movie showing periodic void formation; the long void sheds its tail, which shrinks to form a bullet-like void (see my YouTube movie).

I submitted a paper describing this and received the result of the peer review just before my trip to Russia.

"Specify the decay time of the pump laser power when switching off."

The referee didn't miss the weak point in my paper. However, I had no idea how to obtain the required data. I came up with a solution on the day I returned to Japan.

"I'm sure that camera can provide the answer!"

Very fortunately, I was allowed to use the camera for two hours just ten days before I had to respond the reviewer. However, I acquired the necessary data only when I succeeded in operating the camera with a level of skill that had seemed almost impossible to achieve. The skill was reminiscent of "Shinken Shiraha-dori", a special defense technique used in Japanese traditional swordsmanship, which involves catching a sword blade swung straight at one's face between one's palms (see Fig. 3). I had to capture the fiber fuse extinction by switching off the laser light manually as soon as the running fuse appeared in the camera viewfinder. This required a precision of 1/100 second without any trigger signals. I practiced quenching the fuse at the desired position many times prior to the the two-hour experiment.

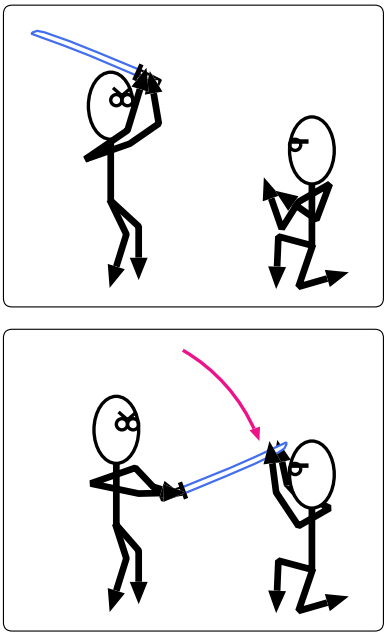

Figure 3: "Shinken shiraha-dori"

When the day arrived, I sat in front of the experimental setup and found I had a "mind like water" to use a Zen expression. I simply did what I should do without feeling any pressure. As a result, I succeeded in obtaining the image 40 minutes before the time limit. The paper was accepted for publication [7]. Again I published this episode in a domestic magazine. Later, I found that this article was displayed at a monthly exhibition held in a public science library ("Serendipity & lucky chance", May 2007, Kanagawa Prefectural Kawasaki Library).

3 Art of calling unexpected chances

3.1 Three-way classification of unexpected chances

While writing up these two episodes, I realized that there are three kinds of unexpected chances if we consider the way they are brought about. That is to say, (1) chances taken as the result of performing experiments oneself, (2) chances given by someone else, and (3) chances brought about by something other than a human being. For instance, we can find the following cases in the above two episodes. (1) the discovery of a periodic void formation model inspired by an unintended microscope observation (2) the proposal of the camera demonstration and the continuing support, and the acceptance of my instant paper, and (3) the success of the seemingly impossible "Shinken Shiraha-dori" experiment. In terms of the second and third types of chances, do we have no choice but to wait for them?

3.2 Unexpected chances given by someone else

I think we can summon the second type of chance. My fiber fuse research was accomplished with the aid of people whom I didn't know (the salesman and his boss, and the Russian professor) but who acted on my behalf after reading one of my articles. I had written to them without any expectation of receiving responses, but taking every possible care to deliver my message clearly.

Once you have made a deep impression on your readers, they do something of their own accord; take notes, inform their friends and colleagues, report the content at a meeting or in their blog, and thus influence someone else's decision or make contact with you. In other words, your messages begin to disseminate by themselves.

When this chain reaction brings something back to you, you have to call it "a lucky chance". However, it is highly probable that you were the cause if you have regularly published clear reports of your work.

I've learned such writing techniques through mastering oral presentation skills. The beginning was a training course I took 14 years ago when I discovered how poor my presentation ability was. Since then, I became interested in practical presentation techniques and have improved my skill. Consequently, I was asked to give a lecture on this topic and realized, when I was preparing the corresponding textbook, that the basis for delivering messages is the same in oral presentations and writing; that is, inspire your audience to act.

Every specific delivery technique is designed to inspire your audience. For example, focus on three main points, mention the conclusion at the beginning, and practice and polish your talk many times. The objective is to deliver a clear message to your audience to induce a spontaneous reaction that may return to help you.

3.3 Chance cause diagram

Provided that we can indirectly summon unexpected chances brought about by someone else, it is possible to consider a contribution ratio of chance causes; myself, someone else and others. For any chances we can determine this ratio subjectively and plot it on a ternary diagram. For example, the first type of chances defined in Sec.3.1 is plotted in the left corner of the diagram shown in Fig. 4(1). The position of the second type is shifted to the left if you have been trying to inspire your audience (see the arrow in Fig. 4(2)).

Then, the proverb "Heaven helps those who help themselves" teaches us that the position of the third type is shifted downwards if you have made an unceasing effort to summon the first and second types of chances (see the downward pointing arrow in Fig. 4(3)).

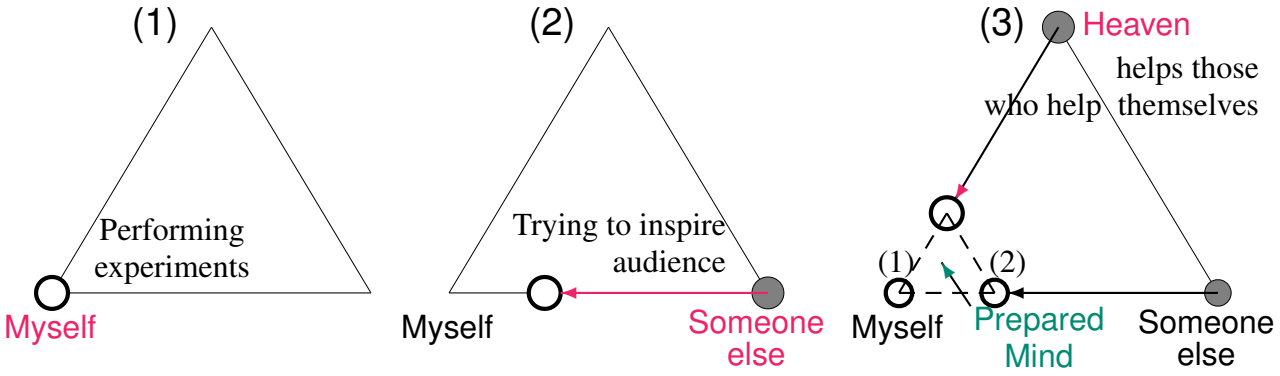

Figure 4: Chance cause diagram showing my, someone else's and heaven's contribution.

Table 1: A chronological table of my fiber fuse research. Boldface letters represent materials published on the net and stars (★) indicate the responses.

'yy m	Episode 1	Episode 2
'04 5	Proposal of demonstration	
8	In situ observation	
9	Talk at conference	
11		Inspiration from voids image
'05 5		"Shinken Shiraha-dori" experiment
8		**Movie published in OA journal [8]**
'06 4	**Japanese article published**	
11		★ Request for contribution
		YouTube submission
		★ Received e-mail
'07 2		**English translation [9] published**
3		**Japanese article published**
	— Talk at symposium —	
5		Displayed at exhibition
'08 5		★ Introduced in science blog

The most important point to keep in mind is that you can recognize these two arrows only after you have encountered the corresponding chances. You cannot optimize and minimize your effort beforehand with an expectation of obtaining specific chances. Only untiring endeavors is required. "Chance favors the prepared mind", said Louis Pasteur (1822-95).

4 Internet-driven serendipity

4.1 Episode 3

Once you have prepared materials to inspire your audience, their dissemination can be promoted by simultaneous publication on the net. The following episode concerns the responses I received via the Internet as summarized in Table 1.

One day about eighteen months after I succeeded in the "Shinken Shiraha-dori" experiment, I came to know about YouTube through a TV program, and immediately submitted some short videos about fiber fuses. Surprisingly enough, the following morning, I received a detailed question via e-

mail from an overseas researcher. Although similar videos of mine had already been published in an open access journal [8, 10] the previous year, they had not been seen by the questioner.

On the other hand, I uploaded the manuscript file of Episode 1 to my homepage and it caught an editor's eye. She asked me to contribute a serialization of the story to her magazine devoted to engineering materials. Since I was looking for an opportunity to publish Episode 2, I happily consented.

While writing that article, I heard some sad news. The Russian researcher who had provided the clue to this episode had passed away. I became anxious about the Russian professor who was older than him. I began to translate the two episodes, which I knew would take considerable time, and send the full version [9] to him via e-mail. I was glad to receive his reply in which he stated "I have read it with great interest." I also published this translation on my homepage.

One day during the following year I checked the access statistics of my YouTube site and found that it had been visited many times on a certain day by people in Spain. The web site retrieval result told me that a Spanish science blog had introduced my video and essay with a message, "es muy curioso de leer" (It's a very interesting article)[‡].

4.2 Invitation to self-archive your manuscripts

All the reactions of the people in this episode were triggered by my online videos and documents. In other words, the trigger was self-archiving; depositing digital files of research output in a publicly accessible website. There is no problem with self-archiving documents that have been published on other media as long as the publisher's rights are not violated. Since most academic journals allow the authors to publish the final version of their manuscripts, any researchers can easily embark on self-archiving.

There may appear to be little worth in self-archiving papers that have already been published in online journals. However, this is not true if you think of their readership. If the journal is accessible only to paid subscribers, other people can not reach your articles via search engines. Online publication of your articles, which is within an author's rights, attracts a wider readership.

These additional readers will probably be working outside your specialized field and trust your peer-reviewed papers without reservation. For example, Wikipedia articles rely strongly on peer-reviewed online articles. Self-archiving is the equivalent to laying the foundations for summoning unexpected opportunities. The same goes for paper-based off-line journals.

Once you gain a readership on the net, you will have more chances to obtain responses via search engines, just like the discovery of Spanish science blog described above. Even if very few readers post their comments on the net, they will certainly provide you with the impetus to continue self-archiving.

You can understand the macroscopic response via the number of visitors to your homepage and the download counters of your files. In my case, I began to increase the numbers of self-archived domestic articles after mid 2006 and this was followed by an increase in visits to my website [11].

4.3 Service for self-archiving

Recently, useful self-archiving services have become available. A typical example for the general public is `Scribd.com`, known as the "YouTube for documents", where I've deposited some work[§]. Many universities and research institutes have institutional repositories for collecting and disseminating their research outputs. As an author, my impression is that the former provides an easy-to-use

[‡]http://francisthemulenews.wordpress.com/2008/05/17/

[§]http://www.scribd.com/tdrks Refs. [9] and [11] are available.

interface and up-to-date responses from the net, whereas the latter is a standardized database offering reliability and persistence.

The repository of my institute opened a test service in September 2008 [¶]. Since this system is being developed as cooperative research with the Max Planck Digital Library in Germany, users' feedback is readily reflected in further improvement. I'm happy to cooperate with this project to foster a new standardized database providing a lot of fun.

5 Closing

Since the chance phase diagram is based on a subjective analysis, it is difficult to find practical examples of others and I can only provide my trivial cases. I hope you will keep the idea of this diagram in your mind and let me know when you find additional interesting cases, or publish them through self-archiving. Our research and development world will become increasingly vigorous if many inspiring messages are circulating around us to induce a lot of serendipitous research results.

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[¶] http://pubman.mpdl.mpg.de/pubman/ To see my articles, type "todoroki" and hit the search button.

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- All the references written by me have been self-archived. You can find them via search engines.