Chance favors the prepared mind

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Dans les champs de l'observation le hasard ne favorise que les esprits préparés.
— Louis Pasteur (1822–1895)

I am working as a researcher in Tsukuba Science City in Japan, and I am mainly investigating optical fibers. I am sure some readers have fiber optic lines installed in their homes for high speed Internet access. Optical fiber is a fibrous form of glass that is used for transmitting optical signals. Its data rates are far greater than those of electronic signals over metal cables. This is why we can watch movies on personal computers connected via optical fiber.

By the way, do you know that optical fibers may be damaged by transmitted light? The following tells how I succeeded in a very difficult optical fiber experiment under restrictive conditions four years ago.

Since optical fibers are made of transparent glass, the transmitted light leaks out when a fiber cable bent sharply. Moreover, the plastic coat often burns if the light is too strong. More than twenty years ago it was found that this heat triggers a strange phenomenon; a dazzling light appears and runs along the fiber like the flame along a fuse attached to a stick of dynamite.

Figure 1 shows a "fireball" propagation in a fiber cable. In reality, it is not burning at all. The bright spot in the fiber is traveling at about 1 meter per second leaving a row of voids that makes the fiber useless because light can no longer propagate in the "burned" cable. This phenomenon must be avoided completely by companies providing fiber optic lines.

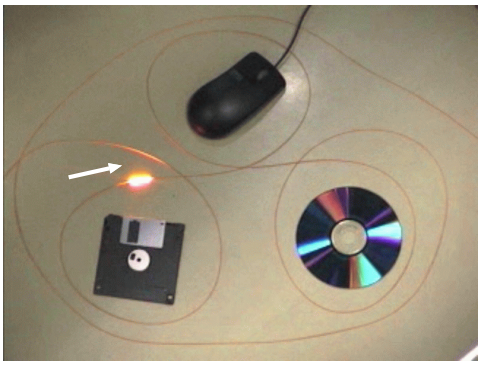

Figure 1: A "fireball" propagation. Its movie is available at YouTube.com.
http://www.youtube.com/Tokyo1406

Such an event never occurs if propagating light is sufficiently weak. However, the demand for faster data transmission rates is growing due to the increasing use of the Internet, and optical lines are required to transmit more optical signals. Thus, there is a clear need to solve the "fireball" problem.

Four years ago, I discovered the mechanism that causes voids to form during the "fireball" propagation, and submitted a paper about it to an academic journal. The result of the peer review was very strict. To satisfy the reviewer, I had to perform an additional experiment that required a high-speed video camera unavailable in my laboratory and a superior operating skills.

I consulted a camera supplier of my acquaintance and found that he was scheduled to demonstrate the same camera near my institute. Fortunately, he allowed me to use it for two hours before the demonstration. This was only ten days before I had to respond the reviewer.

The superior skill that was needed was reminiscent of "Shinken Shirahadori", 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. 2). I had to take a video of the running "fireball"

being extinguished by switching off the light source manually as soon as I saw the “fireball” in the camera viewfinder (see Fig. 3). I had to adjust the timing manually with a precision of 1/100 second and without any trigger signals. I practiced many times to quench the “fireball” at the desired position prior to the the two-hour experiment.

It was early morning on a fine day in May. I met the suppliers and we went by car to my laboratory. Very strangely, I felt no anxiety despite the fact that my paper would be rejected if the experiment were unsuccessful. In fact, I felt full of joy at this great opportunity of performing another interesting experiment with people that I knew.

In the preceding year, we had met by chance and succeeded in taking an ultra high-speed video of a propagating “fireball” for the first time anywhere in the world. Immediately, I submitted a paper to an international conference. Very fortunately an expert on this phenomenon was a member of the program committee, and coincidentally was also trying to video it. He insisted that the committee accept my paper[1] and he prevailed.

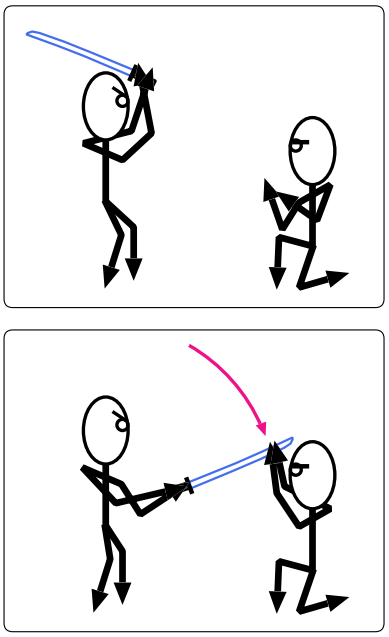

Figure 2: “Shinken shiraha-dori”

I sat in front of the experimental setup and was still calm. I must have had a “mind like water” to use a Zen expression.

I ignited the “fireball”, switched off the light to extinguish it in front of the camera, checked the playback and then repeated this procedure if the recording was unsuccessful. When I replayed the 7th trial, a light spot appeared at the edge of the screen and then suddenly disappeared. I had obtained the required data, and the paper was subsequently accepted for publication[2].

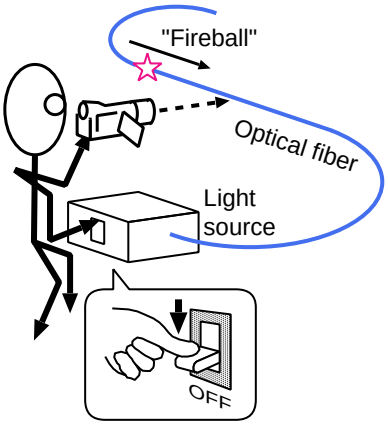

Figure 3: Experimental setup.

Later, I had a opportunity to write these episodes[3] and became convinced of general rules that explain why a series of lucky chances had been brought about.

Something happens to you by chance because you have the sensibility to grasp it. Needless to say, these chances occur when you perform experiments with your own hands (See Fig.4(1)). Moreover, someone may help you by chance because you transmit a message to his/her mind. I always take every possible care when preparing presentations and writing papers. I think about how I can attract attentions at the beginning, maintain interest, and end the story leaving a deep impression.

Once you have made a deep impression on the audience, they do something of their own accord; take notes, inform their colleagues, report the talk at a meeting, and thus influence someone else’s decision. When this chain reaction brings something back to you, you call it “a lucky chance” (See Fig.4(2)). The judge in the conference recommended my paper because it had caught his eye. The supplier visited me to offer the use of his system for nothing because he had seen a poster describing my research results.

Once you begin to gain momentum in attracting such lucky chances, heaven helps you with miraculous success(See Fig.4(3)), just like the “fireball” experiment described above. Or perhaps this statement is over confident.

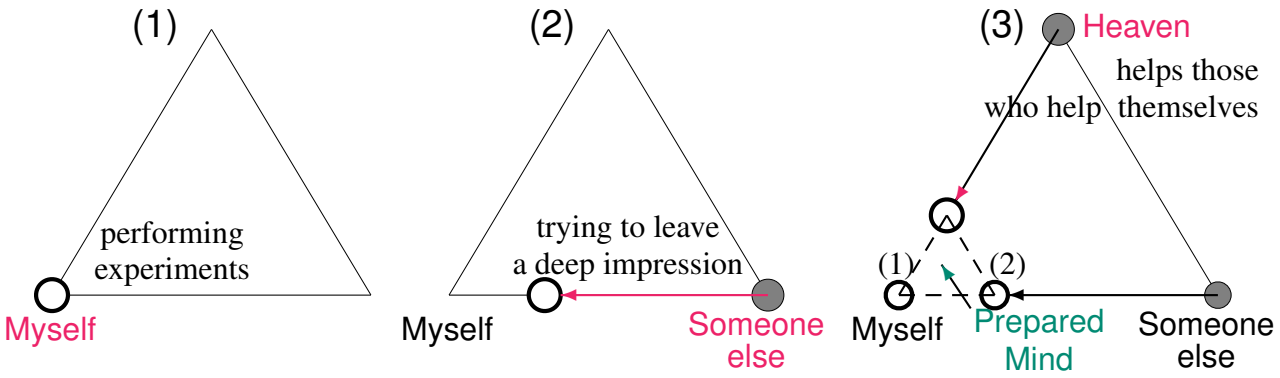

Figure 4: Chance cause diagram showing my, someone else's and heaven's contribution.

References

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[2] S. Todoroki: "Animation of fiber fuse damage, demonstrating periodic void formation", Opt. Lett., **30** [19] pp. 2551–2553 (2005).

[3] S. Todoroki: "Two serendipitous episodes — How I embarked on fiber fuse research", (2007), Translated from 2 articles in Japanese; Electric Glass, **35**, pp. 14–18 (2006) and Industrial Materials, **55** [4] pp. 97–101 (2007).