Shamelessness Shouldn't Be Anyone's Nature
——An Open Letter to *Nature* (Part XXII)

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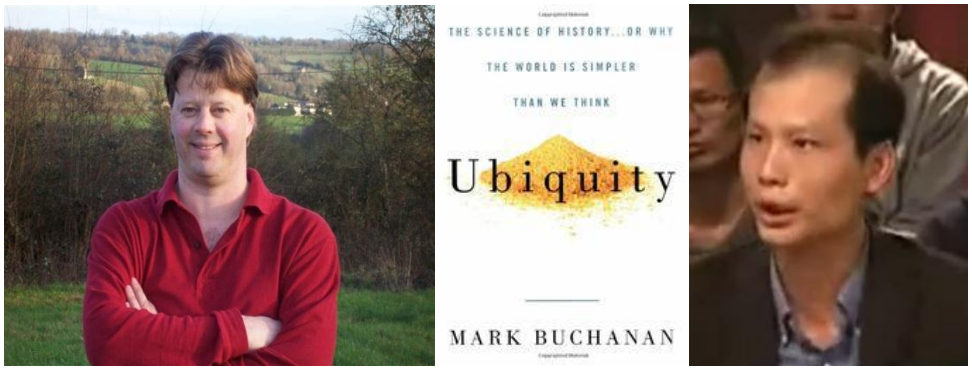
【Summary】

On May 12, 2008, right after the Great Sichuan Earthquake killed tens of thousands Chinese people, Fang suddenly became China's No. 1 seismologist, and his only mission was to propagandize the unpredictability of earthquakes. On September 9, 2009, in the midst of the California wildfires, Fang, out of nowhere, changed to a wildfire expert, blaming American government's wildfire policy. One week later, Fang pretended a paleontologist, laughing at the scientists who had been looking for the causes of the mass extinctions. So, what these three subjects have in common? The answer is, all of them were the subjects discussed in Dr. Mark Buchanan's book *Ubiquity*, and Fang plagiarized every one of them. In other words, Dr. Buchanan was plagiarized by Fang at least 4 times in a period of 16 months.

【Content】



Major Characters

From left: Dr. Mark Buchanan, the victim; *Ubiquity*, the book; Fang, the thief

The publishers of Fang's stolen articles

Mr. Xu Wenxin (徐文新), the president of *China Youth Daily*; Mr. Chen Xiaochuan (陈小川), the editor-in-chief of *China Youth Daily*; Mr. Zhou Mingwei (周明伟), the director of China International Publishing Group which owns Dolphin Books; and Mr. Yu Xiaoqun (俞晓群), the president of Dolphin Books.

China Youth Daily published Fang's *The Dream and the Reality of Earthquake Prediction* on May 28, 2008; *Avalanching like a Sandpile* on June 4, 2008; *Unstoppable Wildfires* on September 9, 2009; and *Why Did Mass Extinctions Occur Repeatedly* on September 16, 2009. The four articles were republished in Fang's book, *Why Elephants Don't Have Hairs?* in 2010 by Dolphin Books. All four articles were plagiarized, partially or completely, from Dr. Mark Buchanan's book, *Ubiquity*.

Fang's Plagiarism History: The Ubiquity Case

The Story

On May 12, 2008, at 02:28:01 PM, an earthquake that measured at 8.0 Ms struck the Wenchuan area, Sichuan Province. The so called the Great Sichuan Earthquake caused nearly 70,000 casualties, and left nearly 5 million people homeless[1].

On the very same day, Fang, who had no training whatsoever in seismology, geophysics, or even physics, wrote an article entitled *Earthquake Experts Shouldn't Be Over-blamed*, defending for Chinese seismologists' failure to predict the quake. According to Fang, it was not just Chinese experts who were incompetent; the experts in the developed nations were incompetent also, because:

> "At present, there are no generally acknowledged reliable methods which could accurately predict the occurrence of earthquakes. According to the once popular complexity theory, the occurrence of earthquakes is a complexity phenomenon, involving many accidental factors, therefore, it is impossible to predict accurately."[2]

However, in an article published in 2000, Fang wrote:

> "But, difficult to predict does not equal to impossible to predict. Sometimes, the prediction on complex systems could reach amazing accuracy.……The assertion that the emergent properties of complex systems are unpredictable will definitely oppose the traditional scientific method "theoretical prediction-test," oppose the exploration of general laws…."[3]

So, why did Fang slap his own face in 2008? The answer is very simple: many Chinese seismologists who were conducting earthquake prediction were also Fang's harsh critics, and Fang's hatred toward them went back as early as 2003, therefore, he tried to use the Sichuan Earthquake as an opportunity to destroy them[4]. Because of that, Fang immediately launched a campaign to attack those seismologists who

believed that earthquakes are predictable, and labeled them as cheaters or liars, and label earthquake prediction as pseudoscience[5]. The strange thing is, just a little more than one year earlier, Fang had called earthquake prediction "serious research."[6]

On May 28, 2008, Fang published his second article on earthquake, *The Dream and the Reality of Earthquake Prediction*, in *China Youth Daily*, in which he labeled earthquake prediction as pseudoscience, like fortune-telling[7]. It was found out later, Fang stole several paragraphs from Dr. Mark Buchanan's *Ubiquity*[8].

On June 4, 2008, Fang published his third article on earthquake prediction, *Avalanching like a Sandpile*, in *China Youth Daily*. The article contains 8 paragraphs and 1,596 Chinese characters, and its main content was about the development of self-organized criticality theory from the sandpile game, and the similarity between the avalanches of sandpiles and earthquakes: since the former is unpredictable, so is the latter[9]. Four days later, Fang, as a science writer and pseudoscience fighter, went to China Central Television (CCTV), to tell Chinese people that story[10]. In April, 2010, Fang appeared on Shenzhen Satellite TV to introduce the "main stream opinion in international academic community" again[11]. In September, 2010, these two articles were republished in *Why Elephants Don't Have Hairs?*.

An inhumane creature

On June 8, 2008, Fang, as a special guest of CCTV, exuberantly told CCTV audience that earthquakes could not be predicted. Fang was the only one who was joyous and jubilant on CCTV when the whole nation was still in mourning. Fang also lied to Chinese people that he lived in California for 10 years[12].

Slapped by an expert

On April, 2010, Fang participated in a TV debate on the predictability of earthquakes on Shenzhen Satellite TV. Mr. Sun Shihong (孙士鋐), the chief forecaster of the China Earthquake Administration, reprimanded Fang Zhouzi face-to-face by saying Fang doesn't understand basic concepts in seismology[13].

On Dec. 15, 2010, a member of AIR-China under the web ID "Hong Qiao" informed me that Fang's *Avalanching like a Sandpile* was plagiarized from Mark Buchanan's *Ubiquity*. Before that, Hongqiao had found two other plagiarism cases committed by Fang, which were later handled by two Academic Misconduct Assessment Panels organized by AIR-China[14]. Hong Qiao was also the person who first discovered the plagiarism committed by Fang's wife, Liu Juhua, in her Master's degree thesis[15].

According to Hong Qiao, *Avalanching like a Sandpile* was the most serious plagiarism committed by Fang by then, because almost every sentence he wrote had corresponding sentence or sentences in Dr. Buchanan's book. After brief reading the book, I identified Fang's plagiarism in his *The Dream and the Reality of Earthquake Prediction.* And I thought, till two days ago, Fang plagiarized Dr. Buchanan only twice. Obviously, I was wrong.

While I was trying to write up the sandpile case into English in the past week, showing Fang's unscrupulous greed when he steals from other people, I found Fang had written two more articles, both published in *China Youth Daily* in September, 2009, and in *Why Elephants Don't Have Hairs?* In 2010, talking about power law, the distinct feature of self-organized criticality. Since Fang's ignorance in mathematics, as well as in any other subjects, is well-known, it was obvious to me that Fang had plagiarized someone, and Dr. Buchanan was the candidate No.1. After comparing with *Ubiquity*, the two articles by Fang were identified as plagiarism, which was a landmark event by itself, since it made Fang's total plagiarism cases surpassing the 100th mark[16].

Four newspaper pages of *China Youth Daily* which contain Fang's column articles (red boxes) stolen from Dr. Buchanan's Ubiquity

From top left (clockwise): *The Dream and the Reality of Earthquake Prediction* (May 28, 2008); *Avalanching like a Sandpile* (June 4, 2008); *Why Did Mass Extinctions Occur Repeatedly* (September 16, 2009) and *Unstoppable Wildfires* (September 9, 2009).

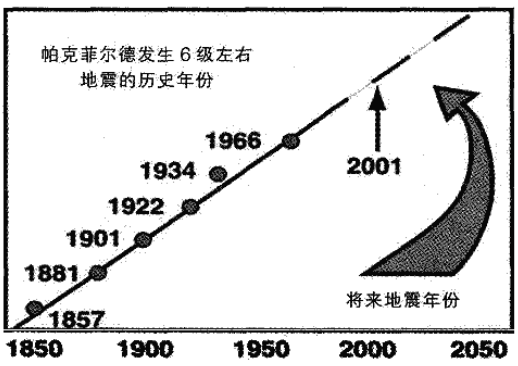
The Evidence

1. *The Dream and the Reality of Earthquake Prediction*

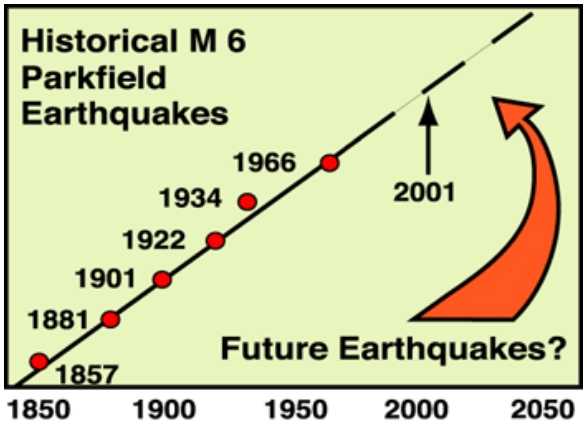
It seems that Fang just started reading Dr. Buchanan's *Ubiquity* when he wrote this article on May 25, 2008, because he only plagiarized two examples of failed earthquake predictions from Ubiquity. The two examples are the "great Tokai earthquake" prediction in 1970s in Japan, and the Parkfield earthquake prediction in 1980s in the United States. Admittedly, Fang could copy the two examples from many other sources, but the way in which he told these stories, and the detailed information he provided in his article, revealed that his source was most like Dr. Buchanan's book.

For example, Fang wrote: "In 1979, researchers at the U.S. Geological Survey noticed that in the Parkfield area in California, earthquakes with magnitude between 5.5 and 6 occurred periodically," which resembles Dr. Buchanan's "In 1979, geophysicist William Bakun and some of his colleagues⋯ noticed that all the Parkfield quakes had magnitude between 5.5 and 6." (pp. 31-32). The thing is, "William Bakun and some of his colleagues" didn't say that "all the Parkfield quakes had magnitude between 5.5 and 6" in 1979[17], and according to the renowned seismologist Hiroo Kanamori, the information about Parkfield earthquakes "(1) the location of these events are not accurately known, (2) the record before 1900 is uncertain, (3) the 1857 event is an immediat foreshock of the M≈8 Fort Tejon earthquake and is not an isolated event like the other events, and (4) the range of inter-vent intervals is actually fairly large, 12 to 32 years."[18]

So, if not stealing from Dr. Buchanan, where did Fang get his "magnitude between 5.5 and 6"?



▲ 加州帕克菲尔德在历史上很有规律地定期发生 5.5~6 级地震，平均间隔时间大约是 22 年。



The evidence of stealing

In the book version of *The Dream and the Reality of Earthquake Prediction*, Fang inserted a figure (left, *Why Elephants Don't Have Hairs?* p. 266) showing "in the Parkfield area in California, earthquakes with magnitude between 5.5 and 6 occurred in the history periodically," the historical range was from 1857 to 1966. In fact, the figure shows Fang stole Dr. Buchanan first, in 2008, then stole USGS website later, in 2010.

A Comparison between Fang's *The Dream and the Reality of Earthquake Prediction* and Buchanan's *Ubiquity*		
Fang's Article		**Buchanan's *Ubiquity***
Chinese	**English Translation**	
上个世纪 70 年代末，日本地震学家们相信在日本中部将很快会有一场 8 级左右的'东海大地震'。日本东海地区据估计平均大约 120 年发生一次大地震，此时距上一次大地震（1854 年）已过了 120 年，大地震的发生似乎迫在眉睫。日本政府为此采取了一系列紧急措施严阵以待。但是'东海大地震'至今还没有发生，却在 1995 年出乎意料地发生了死伤惨重的神户大地震。……	In the late 70s of last century, Japanese seismologists believed that a "great Tokai earthquake" with magnitude about 8 was about to hit central Japan. According to estimate, great earthquakes struck Japan's Tokai region once in about 120 years on average, and by then more than 120 years had passed since the last one (1854), the occurrence of the great earthquake was imminent. The Japanese government adopted a series of emergency measures to prepare for its coming. Till today, the "great Tokai earthquake" hasn't come yet, but the devastating Kobe earthquake occurred in 1995 unexpectedly.	In the late 1970s, Japanese scientists were sure that a "great Tokai earthquake" was soon to hit central Japan. As one researcher put it, "Many Japanese seismologists, earthquake engineers, and national and local officials responsible for disaster prevention are quite convinced nowadays that a great quake of magnitude 8 or so will hit the Tokai area… The targeted area was often struck by great earthquakes in historical times …The mean period of recurrence of great earthquakes there is estimated at about 120 years. As more than 120 years have already passed since the last shock, there is reason to believe an earthquake will recur sooner or later."…Believing this idea, Japanese authorities in the 1970s set up an early warning system. … But decades later, there has been no great Tokai earthquake. Not even a murmur. The Kobe quake occurred in an area where the authorities thought the risk was small." (pp. 29-30)
1979 年，美国地质勘探局的研究人员注意到，在加州帕克菲尔德这个地方，似乎很有规律地定期发生 5.5～6 级地震，平均间隔时间大约是 22 年。最后一次发生于 1966 年，据此预测下一次应该发生于 1988 年左右。1985 年 4 月，美国地质勘探局发布预测，在未来的 5～6 年内帕克菲尔德将会发生一次大约 6 级的地震。……	In 1979, researchers at the U.S. Geological Survey noticed that in the Parkfield area in California, earthquakes with magnitude between 5.5 and 6 occurred periodically, the average time between quakes was twenty-two years. Since the last quake hit in 1966, the next should occur around 1988. In April, 1985, the U.S. Geological Survey issued a prediction, saying that a quake should occur near Parkfield within the next 5 to 6 years.	In 1979, geophysicist William Bakun and some of his colleagues at the U.S. Geological Survey in Menlo Park, California, noticed something interesting about the record of past earthquakes on a small segment of the San Andreas Fault near the rural community of Parkfield, … Counting the numbers of years between these quakes, the U.S.G.S. researchers found the fairly regular sequence…the average time between quakes was twenty-two years. …Bakun and his colleagues noticed that all the Parkfield quakes had magnitude between 5.5 and 6." (pp. 31-32)

2. *Avalanching like a Sandpile*

As mentioned above, the case was initially identified by Hong Qiao, who believed that it was Fang's most serious plagiarism. Indeed, the whole article was translated from *Ubiquity*, many sentences were verbatim translation. Admittedly, Fang did make his own contribution by substituting an example of normal distribution offered in the book with one of his own. (See sentence II-4 in the table below.)

Since the entire text of Fang's article was based on *Ubiquity* by Dr. Buchanan, who has a Ph. D. degree in physics from the University of Virginia[19], Fang had no chance to make his characteristic stupid mistakes. However, his stupidity was revealed in the title of his article: earthquakes have nothing in common with the avalanche of sandpiles, except for that the latter happened to be the model for self-organized criticality. On the other hand, according to Dr. Buchanan, the so called BTW model doesn't mimic the avalanching in a real sandpile[20]. So, what does the title mean?

Fang's ignorance and stupidity was also revealed when he preaching the unpredictability of earthquakes solely on the fact that the relationship between the magnitude of an earthquake and its occurrence frequency resembles the power law. He obviously didn't, and still doesn't, know that not only the resemblance has been challenged[21], but also a power law distribution/self-organized criticality does not exclude the possibility of prediction, to some extent[22].

Fang's stupidity was revealed thoroughly in the following episode. In *Ubiquity*, Dr. Buchanan summarized the finding of sandpile avalanche modeling by Bak and his colleagues this way:

> "Double the number of grains involved, and the avalanche becomes just a bit more than twice as unlikely (more precisely, about 2.14 times as unlikely)."

Fang translated the sentence into this:

> "Increasing the number of grains involved in an avalanche one fold, and the frequency of occurrence decreases 2.14 times." (Sentence VII-1)

Obviously, Fang didn't know the number 2.14 was not present in Bak's original paper, and it was possibly Dr. Buchanan's own calculation. The funny thing is, Fang even didn't know what the sentence means. On the day Fang posted the article on the New Threads, one of his followers asked Fang: does his "decreases 2.14 times" means "1/(1+2.14)"? It took Fang almost 24 hours to answer the question, indirectly:

> "Didn't you learn your elementary math? According to '*Math Book VI For Teachers*' published by People's Education Press in 2002, 'Increasing N times means multiplying with N, decreasing N times means dividing by N.'"[23]

One person asked: How about increase or decrease one time? Fang's answer: they mean no change at all[24].

The stupidities listed above demonstrate unequivocally that Fang has no knowledge in either "elementary math" or seismology. Then, if not by stealing, how could he write his *Avalanching like a Sandpile*?

3. *Unstoppable Wildfires*

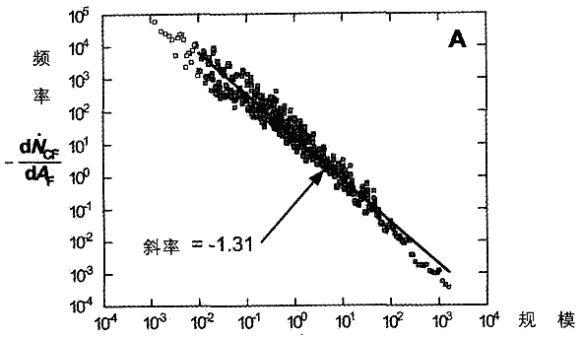
I have pointed out repeatedly that Fang's so called science writing, besides those scifool articles, is nothing but to attract readers' attention by chasing the hot topics, whatever they are; and whatever they are, Fang would pretend he is the expert in the area. *Unstoppable Wildfires* is a perfect example: like his pretending a seismologist after the Sichuan Earthquake in 2008, Fang pretended a wildfire expert when the wildfire in California became a big new in China.

Like what he did in *Avalanching like a Sandpile*, Fang's translation in *Unstoppable Wildfires* was loyal, so he didn't make many obvious mistakes. However, unlike *Avalanching like a Sandpile*, Fang did read the original paper published in *Science* (Malamud, et al. 1998. *Science* 281:1840-1842). As a matter of fact, Fang not only lifted some sentences from the paper, he also lifted a figure from it, without acknowledgment. Maybe Fang has a special permit from *Science* for stealing at will. After all, he is a "fraud buster" certified by *Science*[25].

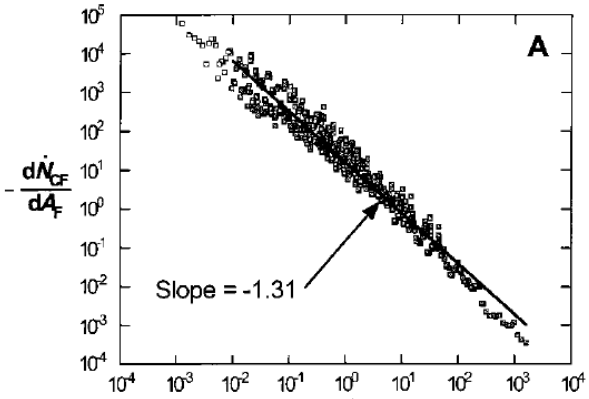
Having learned from his mistake made 16 months ago, Fang didn't steal Buchanan's this sentence:

> "Once again we find the same geometric pattern: double the area covered by a fire, and it becomes about 2.48 times as rare, and the pattern holds for fires varying in size by a factor of a million." (p.68)

"Nothing in biology makes sense except in the light of evolution". Yes, even a thief evolves. Long live Charles Darwin!



▲ 野火规模的发生频率遵循幂律,规模(横轴,取对数)越大,则发生的频率(竖轴)越低。



The "fraud buster" certified by *Science* magazine busted his certifier's copyright policy, again

In 2010, when his *Unstoppable Wildfires* was republished in his *Why Elephants Don't Have Hairs?*, Fang inserted three images, one of them was the one on the left (p.62). The image on the right is the original, published in *Science* magazine (Malamud, et al. 1998. *Science* 281:1840-1842).

4. *Why Did Mass Extinctions Occur Repeatedly*

Apparently, Fang found many new things in his old prey when he reread *Ubiquity* in September, 2009, hence his *Why Did Mass Extinctions Occur Repeatedly*. In the article, Fang not only stole from Dr. Buchanan the information, the wordings, the development of arguments, he also stole Dr. Buchanan's speculations or conjectures.

The concrete evidence for Fang's plagiarism of Ubiquity is shown in this sentence:

> "However, in 1998, two physicists analyzed Sepkoski's data from a different angle to see the distribution of extinctions, and they got a surprising discovery: double the size of the extinction, such events become four times as rare." (Sentence IX-3)

It appears that the sentence was based on the following passage in Ubiquity:

> "In 1996, the physicists Richard Sole and Susanna Manrubia took a more careful look at Sepkoski's data and found that the distribution of extinctions according to their size (this being taken as the number of families that went extinct) follows our old friend the power law. In fact, ……if you double the size of the extinction under consideration, you find that such events become four times as rare." (p.96)

The thing is, "the physicists Richard Sole and Susanna Manrubia" neither "analyzed Sepkoski's data from a different angle" in 1998, nor did they make the discovery. The phenomenon of extinctions' power law distribution was discovered by 4 physicists, including Per Bak, who made the discovery in 1995[26]. In their 1996 paper, Richard Sole and Susanna Manrubia explicitly acknowledged the fact[27]. So, where did Fang get his (mis)information?

It is really amazing that a Michigan State University Ph. D. in biology steals from a University of Virginia Ph. D. in physics, in the area of evolutionary biology! Way to go, Spartans!

A Complete Comparison Between Fang Zhouzi's *Avalanching like a Sandpile* and Mark Buchanan's Ubiquity			
	Fang's *Avalanching like a Sandpile*		Mark Buchanan's *Ubiquity*
Seq.	**Chinese**	**English Translation**	
I-1	1988 年夏天的一个平常早晨，在美国新罕布什尔州一个小学校举行的一个学术会议上，来自加州大学洛杉矶分校的地球物理学家 Y.Y.卡根做了一次关于地震研究的讲座。	It was an ordinary morning in the summer of 1988, at a scientific conference held in a small school in New Hampshire, Y. Y. Kagan, a geophysicist from UCLA, was giving a lecture on earthquakes.	So it was one morning in the summer of 1988, at a scientific conference held at a small college in New Hampshire. On this particular morning, geophysicist Yakov Kagan was giving a more or less routine lecture on earthquakes, (p. 43)
I-2	因为与会的科学家多数并非地震专家，卡根介绍了一些地震学的基本知识，在告诉听众地震是如何的难以捉摸、无法预测时，也谈到已知的少数几条地震规律之一：古腾堡－里克特定律。	As most scientists attending the conference were not earthquake experts, Kagan gave some general background knowledge about earthquakes. When he told his audience how hard and difficult to predict earthquakes, he introduced one of the few laws ever discovered about earthquakes, the Gutenberg-Richter law.	and, as most scientists attending were not geophysicists, he was offering a general overview. Kagan related the sad tale of the singular failure that he and his colleagues continued to meet in trying to forecast earthquakes. And he also introduced his audience to one of the few hard-and-fast laws ever discovered about earthquakes, a rule describing how often earthquakes of various sizes take place. This rule is known as the Gutenberg-Richter law. (p. 43)
II-1	在 1950 年代，加州理工学院的地震学家比诺•古腾堡和查尔斯•里克特收集了发生在世界各地的几千次地震的资料加以统计，试图从中理出一些头绪。	In the 1950s, seismologists Beno Gutenberg and Charles Richter, working at the California Institute of Technology, collected and analyzed data from thousands of earthquakes all over the earth, hoped to find a clue from them.	In the 1950s, seismologists Beno Gutenberg and Charles Richter, working then at the California Institute of Technology, hoped that a census of earthquakes over the whole earth might reveal some significant pattern that would provide a clue to the causes of quakes. (p. 44)
II-2 II-3	比如说，地震震级发生的频率是不是呈正态分布(出现一条两头少中间多的钟形曲线)？也就是说，是否某个中间震级的地震最为多见，是典型震级？	For example, whether the frequency of earthquake magnitude is a normal distribution (a bell curve with a big hump in the middle)? In other words, whether earthquakes with an average magnitude occur more often; and the magnitude is typical?	Would they find, for example, some most common type of earthquake? …If there were such a thing as a typical earthquake, we should expect the graph to show one big hump –something like the famous bell curve of mathematics (see figure 1). In this case, most quakes would fall at about some normal, average magnitude. (p.44)
II-4	人的身高就属于正态分布，中国成年男性的典型身高大约是 1 米 7，比它高或矮的人数都逐渐减少。	People's heights belong to normal distribution, the typical height of Chinese adult males is 1.7 meter, and the number of people higher or lower than the height is gradually decreasing.	The bell curve is one of the most famous curves in mathematics. Weigh a thousand onions or apples, give a test to five hundred students, or measure the speeds of a few thousand cars as they rush by on the highway: in each case the numbers will fall on a bell-shaped curve, with the vast majority falling close to some average. (p.45)
II-5	但是古腾堡和里克特却未发现有典型震	But Gutenberg and Richter found no typical magnitude whatsoever. The frequency of	But Gutenberg and Richter found no humps whatsoever. (p.44)

	级，震级发生的频率不是正态分布，但也不是毫无规律，而是震级越高，则发生的频率越低。	earthquake magnitudes is not normal distribution, but it is not lawless either. Rather, the higher the magnitude, the lower the frequency.	In terms of energy, it turns out that the Gutenberg-Richter law boils down to one very simple rule: If earthquakes of type A release twice the energy of those of type B, then type A quakes happen four times less frequently. (p. 45)
II-6	而且，它遵循一条简单的原则——幂律：一次地震释放的能量每增加一倍，发生的频率就减少为四分之一。	Also, it follows a very simple pattern─a power law ─: If the energy released by an earthquake doubles, then the frequency of the earthquake reduces to a quarter.	Double the energy, that is, and an earthquake becomes four times as rare. This simple pattern –a power law – holds for quakes over a tremendous range of energies. (p.45)
III-1 III-2 III-3	卡根此前已在其他地方多次做过类似的讲座，这回却有了意外的结果。听众中包括在纽约布鲁克哈文国家实验室工作的丹麦理论物理学家伯•巴克(1948-2002)。在听了卡根对古腾堡－里克特定律的介绍后，巴克突然想到，地震的这种情形很像他正在研究的沙堆崩塌。	Kagan had given similar talks many times before, but this time he had an unexpected result. Danish theoretical physicist Per Bak (1948-2002), working at Brookhaven National Laboratory in New York, was in the audience. After listening to Kagan's introduction to Gutenberg-Richter law, Bak suddenly realized that the occurrence of earthquakes is very similar to the avalanches in their sandpile game.	As chance would have it, Per Bak was sitting in the audience listening to Kagan's talk, and as Kagan spoke, Bak became increasingly intrigued, because he and his colleagues had also found a power law for the avalanches in their sandpile game. (p. 43)
IV-1 IV-2	假如我们往一张桌子上一粒一粒地丢沙子，沙子将会逐渐堆积起来，越来越高，但是不可能一直高下去，随着沙堆变高，它也变得越来越陡、越不稳定，到一定程度，刚丢下去的沙子会引起沙堆的崩塌，让沙堆的高度降低。崩塌之后，继续丢沙子，沙堆又再增高，然后再崩塌，如此循环往复。	If we drop grains of sand one by one onto a table, the sands will pile up higher and higher, but things cannot continue in this way. As the pile grows, it becomes steeper and steeper, and increasingly unstable. It becomes more likely that the next falling grain will trigger an avalanche to lower the height of the pile. After that, continue dropping the grains, the pile grows higher again, and collapse again, alternately grows and shrinks.	Imagine dropping grains of sand one by one onto a table and watching the pile grow. A grain falls accidentally here or there, and then in time the pile grows over it, … , as grains pile up, it seems clear that a broad mountain of sand should edge slowly skyward, and yet things obviously cannot continue in this way. As the pile grows its sides become steeper, and it becomes more likely that the next falling grain will trigger an avalanche. Sand would then slide downhill to some flatter region below, making the mountain smaller, not bigger, as a result, the mountain should alternately grow and shrink, its jagged silhouette forever fluctuating. (p.18)
V-1 V-2	巴克首先想要知道的是一个看来很简单的问题：沙堆崩塌的规模有小有大，什么样的崩塌规模是最典型的？能否预计下一次的崩塌会有多大？	Bak first wanted to know the answer to a simple question: What is the typical size of an avalanche? Can you predict the size of the very next avalanche?	Bak, Tang, and Weisenfeld wanted to understand those fluctuations: What is the typical rhythm of the growing and shrinking sandpiles? (p.18)
V-3	这需要堆许多沙堆进行统计，很费时间，所以巴克就改用计算机程序进行模拟。	This needs to pile a lot of sandpiles, very time consuming. So Bak turned to the computer to simulate the process.	Unfortunately, dropping sand one grain at a time is a delicate and laborious business. So in seeking some answers concerning the rhythm of the pile's growth, Bak and his colleagues turned to the computer. (p.19)
V-4	巴克和他的两名同事研究了数以千计的	Bak and his two colleagues ran thousands of	The researchers ran a huge number of tests, counting the

	“虚拟沙堆”，统计了数百万次的崩塌中的沙子数。	virtual sandpiles, counting the grains in millions of avalanches.	grains in millions of avalanches in thousands of sandpiles, looking for the typical number involved. (p.19)
V-5	他们找到了什么典型崩塌规模了呢？什么也没有。	What kind of “typical” avalanche did they find? They found nothing.	The result? Well … there was no result, for there simply was no “typical” avalanche. (p.19)
V-6	有的崩塌规模小到只有一粒沙子，有的则大到几百万粒沙子。	Some avalanches involved a single grain; some involved millions.	Some involved a single grain; others ten, a hundred, or a thousand. Still others were pile-wide cataclysms involving millions that brought nearly the whole mountain tumbling down.
V-7	什么样的规模都有可能发生，但是并不存在一个典型的崩塌规模，无法预计。	Avalanches of any types could occur, but there was simply no “typical” avalanche. There was no way to predict.	At any time, literally anything, it seemed, might be just about to happen. (p.19)
VI-1 VI-2	这是为什么呢？为了回答这个问题，巴克等人对其程序做了一些改进。	Why is this? To find out the answer, Bak et al. modified the computer program.	To find out why it should show up in their sandpile game, Bak and colleagues next played a trick with their computer. (p.20)
VI-3	设想从上往下俯瞰虚拟沙堆，然后根据沙堆上的每粒沙子所处位置的陡度着上不同的颜色：如果那个位置相对平稳，就着上绿色；比较陡峭，就着上红色。	Imagine peering down on the pile from above, and coloring it in according to its steepness. Where it is relatively flat and stable, color it green; where steep, color it red.	Imagine peering down on the pile from above, and coloring it in according to its steepness. Where it is relatively flat and stable, color it green; where steep and in avalanche terms, “ready to go”, color it red. (p.20)
VI-4	刚开始堆沙堆时，都是绿色的。随着沙子的堆积，红点也逐渐增多，进而形成网络。一粒沙子掉到红点上，就能触发周围红点的滑动。	At the outset the pile looked mostly green, but as the pile grew, the red increased to form a network. A grain falling on a red spot can cause sliding of nearby red spots.	What do you see? They found that at the outset the pile looked mostly green, but that, as the pile grew, the green became infiltrated with ever more red. With more grains, the scattering of red danger spots grew until a dense skeleton of instability ran through the pile. Here then was a clue to its peculiar behavior: a grain falling on a red spot can, be dominolike action, cause sliding at other nearby red spots. (p.20)
VI-5	如果红点很少，新丢下去的沙子的影响就很有限。	If the red network was sparse, then a single grain could have only limited repercussions.	If the red network was sparse, and all trouble spots were well isolated one from the other, then a single grain could have only limited repercussions. (p.20)
VI-6	但是一旦红点多到连成一片，就无法估计新丢下去的沙子会导致什么结果：它可能只是打几个滚就停下了，也可能触发周围的沙子引起一场小规模崩塌，但也可能引起一连串连锁反应，像多米诺效应一样，导致几百万粒沙子一起崩塌。	But when the red sports come to riddle the pile, the consequences of the next grain become unpredictable. It might trigger only a few tumblings, or a small avalanche, or it might instead set off a cataclysmic chain reaction involving millions, like domino action.	But when the red sports come to riddle the pile, the consequences of the next grain become fiendishly unpredictable. It might trigger only a few tumblings, or it might instead set off a cataclysmic chain reaction involving millions. (p.20)
VI-7	这种高度敏感的不稳定状态称为临界状态。	The hypersensitive and unstable condition is called criticality.	The sandpile seemed to have configured itself into a hypersensitive and peculiarly unstable condition in which

			the next falling grain could trigger a response of any size whatsoever. (p.20)
VI-8	由于它是在沙子堆积过程中自己逐渐形成的，巴克称之为自组织的临界状态。	Since it was gradually formed during the piling process, Bak called it "self-organized criticality."	Recognizing a miracle when they saw one, they enshrined it with the name "self-organized criticality." (p.66)
VI-9 VI-12	在这种状态下任何规模的崩塌都有可能发生，但是即使是最大的崩塌的发生也无其他特殊的因素。它是完全不可预测的。	Under this condition, avalanches of any sizes could occur, but even the largest one may take place for no special reason at all. It is completely unpredictable.	In this simplified setting of the sandpile, the power law also points to something else: the surprising conclusion that even the greatest of events have no special or exceptional causes. After all, every avalanche large or small starts out the same way, when a single grain falls and makes the pile just slightly too steep at one point. What makes one avalanche much larger than another has nothing to do with its original cause, and nothing to do with some special situation in the pile just before it starts. Rather, it has to do with the perpetually unstable organization of the critical state, which makes it always possible for the next grain to trigger an avalanche of any size. (p.47)
VII-1	巴克也发现，沙堆崩塌规模虽然不是正态分布，但是遵循幂律：崩塌规模越大，则发生的频率越低，参与崩塌的沙子数目每增加一倍，其发生的频率则降低 2.14 倍。	Bak also found that although the size of avalanches was not normally distributed, it followed the power law: the larger the sizes are, the less frequently they occur: Increasing the number of grains involved in an avalanche one fold, and the frequency of occurrence decreases 2.14 times.	Remarkably, Bak and his colleagues found a similar relationship for avalanches in the sandpile game. Counting up how frequently avalanches of each size happened, they found that avalanches topping anything from a few up to a few million grains follow a regular pattern: Double the number of grains involved, and the avalanche becomes just a bit more than twice as unlikely (more precisely, about 2.14 times as unlikely). (p. 45)
VII-2	所以，巴克一听说震级的频率也遵循幂律，马上就想到地震可能和沙堆崩塌一样，也是一种自组织的临界现象。	So, when Bak heard that earthquake scales also follow the power law, he immediately thought that earthquakes, like avalanches, might also be self-organized criticality.	These details were running through Bak's head as he listened to Kagan's talk about the Gutenberg-Richter power law, and he began to wonder: Could things work the same way in the Earth's crust? If something similar were true of earthquakes, then there would be no essential difference –in terms of causes—between small earthquakes and the really big ones. (p.47)
VII-3	随后他和其他许多人构建计算机模型，对地震进行了模拟。	Afterward, he and many people constructed computer models to simulate earthquakes.	I should mention that Bak and Tang were not alone in making the link between sandpiles and earthquakes. Around the same time, several other researchers simultaneously and independently came to similar conclusions. (p.248)
VIII-1	由于地壳的运动产生的应力逐渐积累，地球处于临界状态。某个地壳断层的某处岩	Owing to the motion of plates, the stress accumulates, the earth is in a critical state.	The Earth's crust is under constant stress owing to the motion of plates, driven to move about by heat in the

VIII-2 VIII-3	石承受不了受到的应力，就会出现滑动，这个滑动可能小到无法觉察。但是正如一粒沙子的掉下会让处于临界状态的沙堆出现无法预测的结果一样，这个小滑动之后，任何情形都可能发生：它可能就此停下来，也可能给附近的岩石带去足够大的应力让它们跟着滑动，引发一场地震，而这场地震的规模是无法预料的。	If the rock along one segment of a fault reaches its threshold for slipping, it slips. The slippage might be too tiny to be detected. However, just like a sand grain could cause unpredictable consequences in a sandpile in critical state, after the tiny slippage, anything could happen next: it may stop, or bring enough stress to the nearby rocks so they slip too, generating an earthquake, but the magnitude of the earthquake is unpredictable.	Earth's interior. This stress builds up until the rock along one tiny segment of a fault reaches its threshold for slipping, and slips. This initial segment might be only a millimeter long. It might even be microscopic. But what happens next needn't be, for the magnitude of the ultimate effect bears no relationship to that of the initial cause. (p.61)
VIII-4	不管是小地震还是大地震，它们的起因都一样，都是由于地球处于临界状态而引起的，此外大地震的发生并无特殊的起因，既无法预测，也没有可靠的前兆，就像大规模的沙堆崩塌一样。	No matter big or small, the initial causes of earthquakes is the same: the Earth is in a critical state. Catastrophic earthquakes strike for no special reason, unpredictable, and without reliable precursors, just like a big avalanche.	Massive quakes may arise out of the very same conditions as small, and quakes of all kinds may be totally unpredictable. As with avalanches in the sandpile game, the largest and most devastating earthquakes may take place when and where they do for no special reason at all. (p.39) Catastrophic earthquakes, then, strike in a very real sense for no reason at all. There is an explanation for why there are such earthquakes in the first place: it is the very fact that the Earth's crust is tuned to be in a critical state, and lives on the edge of upheaval. (p.61)
VIII-5	如果地震有意识的话，在它刚刚发生时它自己都不知道将会有多大规模，而地震自己都不知道，我们更无法知道。	If an earthquake has conscious, when it begins it does not know how big it is going to be. And if the earthquake itself doesn't know, we are even more unlikely to know.	In the picturesque phrase of the earthquake expert Christopher Scholz of Columbia University, it seems that an earthquake when it begins "does not know how big it is going to be". And if the earthquake itself doesn't know, we aren't likely to know either. (p.61)

A Complete Comparison Between Fang's *Unstoppable Wildfires* and Buchanan's *Ubiquity*			
	Fang's *Unstoppable Wildfires*		**Mark Buchanan's *Ubiquity***
Seq.	**Chinese**	**English Translation**	
I	原本湛蓝的洛杉矶天空，变成了灰、红混杂。远处安吉利斯国家森林冒着浓烟。这是洛杉矶郡历史上最大的一场森林大火，从 8 月 26 日烧到现在火势才得到部分控制，已烧掉了约 6 万公顷的林地，占整片森林的 20％以上。美国森林服务局认定这场大火的起因是有人纵火。这个认定并不意外。除了被闪电点燃，90%以上的野火都是人为引起的，不管是有意还是无意。人类与森林的接触日益紧密，森林野火发生的频率也就越高。就在同一时间，全美各地还有十几处森林大火在烧着。但是为什么只有安吉利斯的大火严重到成为了新闻？	The original blue sky over Los Angeles has becoming a mixture of gray and red. Smoke is billowing in Angeles National Forest in the distance. This is the largest forest fire in Los Angeles County history. The fire started in August 26, and it is partially under control only till now. About 20,000 hectares of forest, more than 20% of the forest, has been burned. U.S. Forest Service has determined that the cause of this fire was arson. This is not unexpected. Except for being ignited by lightning, more than 90 percent of wildfires are caused by human, whether intentionally or not. The contact between humans and forests is increasingly close, and the frequency of wildfires is also increasing. At the same time, across the U. S., there are a dozen forest fires burning, why are only Angelis fires serious enough to become news?	
II-1 II-2	一场火灾要能发生和维持，取决于热、燃料和氧气三要素。这三要素只要缺了一个，温度不够高、燃料匮乏或氧气有限，火就无法传播，会慢慢熄灭。	The occurrence and sustainment of a fire disaster depends on three elements: heat, fuel, and oxygen. Lack of any one of them, such as temperature is not high enough, shortage of fuel, or limited supply of oxygen, the fire cannot spread, and will die eventually.	
II-3	在这些要素中，影响野火大小的主要是燃料：树木的湿度、形状、大小、多少、彼此之间的距离、在地面上的排列状况等等都影响着火势的传播，而树木的情况又与树的种类和年龄有关。还有许多环境因素也能影响火势：风能把火吹旺，雨能把火浇灭，河流能阻碍火的传播……	Among these elements, the wildfire is mainly influenced by fuel: the tree's wetness, shape, size, distance from each other, and the patterns they all affect the spread of the fire. Also, the condition of trees is associated with their species and ages. There are other factors which could influence the fire: winds can blow a fire stronger, rains can extinguish a fire, and	Why and how and where fire spreads depends on the kind of trees in its path, on how far apart those trees are, and on the more detailed patterns in which forest and grassland mingle. Winds drive a fire to spread, while rain slows it down. The detailed history of the forest matters too; growth in some regions is much older than others, and this affects how easily it burns. Natural barriers such as rivers can retard the advance of a fire; then again, a hot fire can blow embers clear over a river and set new fires more than a mile ahead. (p.67)

		revers can block a fire's spread…	
II-4	有没有什么一般规律能让我们预测一场野火的规模（即森林被焚面积）呢？比如说，哪种规模的野火最为典型？	Are there some laws which could allow us to predict the size of a wildfire (i. e. the area of a forest burnt)? For example, which size of wildfire is the most typical?	
III-1	1998 年，美国康奈尔大学研究人员用计算机模型对森林野火进行模拟。	In 1998, researchers at Cornell University of the United States used computer to simulate forest fires.	In 1998, the geologists Bruce Malamud, Gleb Morein, and Donald Turcotte of Cornell University gathered extensive data on forest fires in the United States and Australia over the last century. The size of a forest fire is sensibly given by how many trees it burns, or, equivalently, the area that the fire consumes. How large is a typical forest fire? (p.67)
III-2	他们在网格上种虚拟的树，每一步骤在某个格子上种一棵，种在哪一个格子上是随机的，每个格子只能种一棵。随着时间的推移，网格上的树就逐渐地多起来。然后，每隔一定数量的步骤之后，程序就往网格上扔下一根虚拟的火柴，扔在哪里也是随机的。如果扔的那个格子上有树，树就被点燃了。如果这棵树相邻的四个格子上有树，火就传了过去。	They planted virtual trees in grids, each time-step a tree in a grid randomly, one tree per grid. As time turns on, the number of trees increases. Then, after a certain number of time steps, the program drops a virtual match randomly. If the match falls in the square with a tree, the tree catches fire. If the four squares next to the tree have trees also, the fire spreads.	Like the sandpile game, the forest fire game is played on a grid, and, at each time step, the computer plants a tree on a random square. As time turns on, the number of trees increases as they sprout up at random all over the forest. Every so often, however, after a certain number of trees have been planted, the computer drops a match on a random square…When a match falls, it does nothing if it lands on an open square. If it hits a tree, that tree catches fire. The final rule in the game is that, once a tree catches fire, it will at the next time-step set fire to any trees that happen to occupy one of the four squares next to it. (p.69) The forest fire model consists of randomly planting trees on a square grid at successive time steps and, at a specified number of time steps, randomly dropping a match on the grid. A maximum of one tree can occupy each grid site…If the match is dropped on an empty site, nothing happens. If it is dropped on a tree, the tree ignites, and a model fire consumes that tree and all adjacent (nondiagonal) trees. Malamud, et al. 1998. Science 281:1840-1842.
IV	他们反复地运行这个程序，统计每次虚拟野火的规模，并没有找到典型的野火规模，却发现野火的发生遵循幂律，野火的规模越大，发生的频率就越低。	They run the program repeatedly, counting the size of each virtual wildfire, but they didn't find the typical size, rather, they found that the occurrence of wildfire followed power law: the bigger the fire size was, the less frequently it occurred.	Malamud and colleagues ran a number of simulations, and in each they counted how many times they saw fires that burned off a given area of the grid. There were, as in real forests, many more small fires than large. But beyond the mere qualitative agreement, the model also gave rise to a near-perfect power law. (p.69)

V-1	我们以前介绍过，地震、沙堆崩塌的规模大小与发生的频率关系都遵循幂律（参见《像沙堆一样崩塌》，本版 2008 年 6 月 4 日）。	We have introduced before, in earthquakes and the avalanches of sandpiles, the sizes and the frequencies follow power law (see *Avalanching like a Sandpile*, this page, June 4, 2008).	
V-2	幂律表明，大事件和小事件都是由相同的因素引起的，并没有特别的“大”因素。地壳或沙堆处于自组织的临界状态（自身逐渐形成的高度敏感的不稳定状态），在这种情况下任何规模的地震或坍塌都可能发生，大规模地震或坍塌的出现纯属偶然，并无其他的特殊因素，是不可预测的。	Power law indicates that big or small events are caused by the same factors; there are no special factors for “big.” The earth crust or sandpiles are in a self-organized critical state (gradually formed its own hypersensitive unstable state), under such conditions, quakes or avalanches of any sizes could occur, big events occur purely by chance, no other special causes, therefore unpredictable.	Recall that a power law, with its scale-invariant form, implies that large events are just magnified copies of smaller ones, and that they arise from the same kinds of causes. Really, big earthquakes aren’t triggered by special events, but are simply the natural if infrequent consequence of the overall critical organization of the Earth’s crust, and its susceptibility to long-range chain reactions. (p.68)
VI-1	看来发生野火的虚拟森林处于自组织的临界状态，那么真实的森林野火是否也如此呢？	Since the virtual forests in which the wildfires occur are in a self-organized critical state, how about the real forests?	The network of trees on the grid seemed naturally to tune itself to a critical state in which the next match might spark a fire of any size whatsoever, even one that would destroy the entire forest. (pp.69-70)
VI-2	康奈尔大学的研究人员统计了发生在美国和澳大利亚的森林野火，同样没有找到典型的野火规模，并且它们也遵循幂律。	The researchers at Cornell University studied the forest fires occurred in the U. S. and Australia; they did not find typical size of a wildfire, which also followed power law.	Surprisingly, they did not find any indication that there might be a typical size for a fire. For example, their data …reveals a remarkably strong power law. … The Cornell researchers found that the same thing seems to be true for forest fires, not only in the United States, but also in Australia, and presumably everywhere on Earth. (p.68)
VI-3 VI-4	看来森林的确是处于自组织的临界状态。这一发现不仅不能用来预测野火的规模，反而表明大规模野火的发生是不可预测的。	It seems that forests are indeed in a self-organized critical state. The discovery not only couldn’t be used to predict the sizes of wildfires, it indicates that the occurrence of big wildfires is unpredictable.	When a fire starts, it doesn’t yet know how big it will become. Fires spread as they do because any forest has the organization of the critical state, and how far any particular fire goes is largely a matter of chance. (p.68)
VII-1	不过，研究人员通过计算机模拟发现的另一个现象，却对如何控制野火的规模很有启发。	However, another phenomenon discovered by the researchers through computer simulation was helpful for wildfire control.	For the game also turned up one other curious detail, one that may even help the U. S. Forest Service to reduce the number of huge, catastrophic fires in the future. (p.70)
VII-2	他们用不同的点火频率进行模拟。有的模拟每种 125 棵树扔一根火柴，有的每种 500 棵树扔一根火柴，有的则每种 2000 棵树才扔火柴。点火的频率越低，发生大火的频率就越高。在频率低到每种 2000 棵树才扔火柴时，这时网格上已密密麻麻布满了树，扔下的火柴通常点	They simulated with different sparking frequencies. In some run, they dropped one match per 125 trees planted, some one match per 500, some per 2,000. The lower the sparking frequency, the higher the big fire frequency. When the frequency was	The number of fires per time step (*NF*/*NS*) with area (*AF*) is given as a function of *AF* for a grid size of 128 by 128 squares at three sparking frequencies, *f*S 5 1/125, 1/500, and 1/2000 (Fig. 1)··· Large forest fires are dominant when the sparking frequency is small (Fig. 1). This dominance is easily explained on physical grounds. For

	燃大量的树木，在许多情况下甚至烧光了所有的树。	lowered to 2000 trees per match, the grid was covered by trees, and the match dropped usually ignited many trees, in many cases all trees were burned.	small sparking frequencies or small grid sizes, the grid becomes full before a match sparks a fire. The areas of the fires will generally involve a large number of trees, and in most cases, the fires will span the grid. Malamud, et al. 1998. Science 281:1840-1842.
VIII	他们把这称为“黄石公园效应”。在 1972 年之前，黄石公园对野火采取零容忍政策，一旦发现野火就尽量将其扑灭。这就像是模拟程序中超低的点火频率，也出现了类似的后果：1988 年黄石公园突发大火，烧掉了 32 万公顷的森林，占黄石公园面积的 36%。	They called the phenomena “Yellowstone effect.” Before 1972, Yellowstone National Park adopted a zero tolerance policy on wildfires, suppressing as many wildfires as they could. That was analogous to the super low sparking frequency simulation, and it had similar consequence: In 1988, Yellowstone suddenly had a big fire, burned 320 thousand hectares of forest, about 36% the area of the park.	Malamud and his colleagues dubbed this the “Yellowstone effect,” ⋯From 1890 onward, the attitude of the U. S. Forest Service was one of ‘zero tolerance,” even for forest fires sparked by natural causes. The service tried desperately to put out every fire whatsoever. This is the real-world equivalent of dropping matches far less frequently in the forest fire game, and it appears to have had similar consequences. (p.71) This transition can be termed the “Yellowstone effect.” Until 1972, Yellowstone National Park had a policy of suppressing many of its fires, resulting in a large accumulation of dead trees, undergrowth, and very old trees (*8*). This accumulation is analogous to a small sparking frequency in the forest fire model. The grid becomes full, and the likelihood of very large fires is much higher than that in forest fire models with larger sparking frequencies. In 1988, a series of fires in Yellowstone burned 800,000 acres. Malamud, et al. 1998. Science 281:1840-1842.
IX-1	对任何野火都强行扑灭，这样做让森林不再处于临界状态，而是处于更不稳定的超临界状态：森林里充满了老树、死树、矮树、野草，地面堆满了树枝、树皮、枯叶，这些全都是上好的燃料，只要有了火源，就会熊熊燃烧起来，不可抑制地蔓延开去。	Suppressing every wildfire moves the forest away from the critical state, instead, it drives it into an even more unstable supercritical state: the forest is full of old trees, deadwood, brush, grass, twigs, bark, leaves, they are superb burnable materials. Once they catch the fire, they will burn and spread unstoppable.	One of the unintended effects of this program was that the forest began aging. Old trees were not replaced by younger trees, and the natural evolution of the forest’s material changed. Deadwood, grass and twigs, brush, bark, and the leaves accumulated; as a result, the forest moved away from the natural critical state. The trouble is that fires are an indispensable component of the natural dynamics that keep forest in that state, so by suppressing them, the Forest Service has instead driven the forest into an even more unstable state, a supercritical state, with a high density of burnable material everywhere. (p.71.)
IX-2	野火是不可能完全制止的，只会推迟其爆发，推迟得越久，后果就可能越严重。	Suppressing every wildfire is impossible; all it does is delaying the outburst. The longer it delays, the more serious the consequence will be.	

X-1 X-2	美国林业部门后来意识到了野火也是森林自然生态一个不可或缺的部门，对自然因素引起的野火不再扑灭，任其燃烧（除非威胁到生命、财产的安全）；林务员时不时地还在严格控制下有选择地放火烧掉一部分森林。但是要让森林恢复被破坏了近百年的自然平衡还需要时间。	The U. S. forest administrations later realized that wildfire is an important component in the natural ecosystem of the forest, therefore they no longer try to control the wildfire caused by natural causes, unless endangering the life and properties. The forest managers even periodically set fires under strictly controlled condition to burn out some parts of the forest. However, it will take time to redress the natural balance destroyed in the past one hundred years or so.	The U. S. Federal Wildland Fire policy now recognizes the difficult position into which U. S. forests have been put by past practices…Consequently, forest managers are no longer trying to control small and intermediate-size fires. Indeed, they now even set prescribed and managed burns in order to keep the fuel from building up… The U. S. Federal Wildland Fire policy hit the nail squarely on the head in concluding that "wildland fire, as a critical natural process, must be reintroduced into the ecosystem." It may take years to redress the balance, … (p.72)
X-3	如果美国林业部门早一点放弃对野火零容忍的政策，也许 1988 年的黄石公园大火就可以避免，安吉利斯国家森林所在的加州也不至于近年来连连爆发森林大火了。	Had U. S. forest administrations given up their zero tolerance policy earlier, the Yellowstone fires of 1988 might have been avoided, and California where the Angeles National Forest locates, might not have suffered from the repeated forest fires in recent years.	

A Complete Comparison Between Fang's *Why Did Mass Extinctions Occur Repeatedly* and Buchanan's *Ubiquity*			
Fang's *Why Did Mass Extinctions Occur Repeatedly*			Mark Buchanan's *Ubiquity*
Seq.	Chinese	English Translation	
I	自生命起源到现在的数十亿年间，地球上大约出现过数十亿个物种，而现存的物种只有大约数百万个，也就是说，地球上曾经出现过的物种，99%以上都已灭绝。没有一个物种能够永世长存，现存的物种以后也会一个一个地灭绝。物种灭绝是一个一直在发生的过程，大部分（约占三分之二）的灭绝是由于不同物种之间的竞争、环境的变化等进化因素，分散地发生的，被称为背景灭绝。但是剩下的三分之一的灭绝，却是集中发生的，在比较短的时间内，仿佛祸从天降，许多物种一起灭绝，被称为大灭绝。	Since the origination of life till now, billions of years have passed. During the time span, there have been billions of species on the Earth, however, there are only a few million species right now. In other words, more than 99% of the species became extinct. There is not a single species which could survive forever. The current species will become extinct one by one later. Extinction is an ongoing process, most extinctions (about two thirds) were caused by the evolutionary factors such as competitions among species, or changes in environment. Extinctions like these occurred sporadically, they are called background extinctions. The rest one third extinctions, however, occurred collectively, in a short period, it was like a disaster was falling from sky, many species were extinct altogether, which is called mass extinctions.	
II	物种大灭绝让地层中的化石分布出现了断层，某类群的化石完全消失了，而被新的化石类群所取代。地质学家根据古生物化石类群的更替现象来划分地质年代，把地质年代划分为古生代、中生代和新生代三个时期，每代之下再分为几个纪。	The mass extinctions made the distribution of fossils in the crust discontinue, fossils of some organisms disappeared, replaced by new fossil groups. Geologists divide the geological eras based on the turnover phenomena of the fossils: Paleozoic, Mesozoic, and Cenozoic; each era is further divided into periods.	
III	古生物化石的更替现象在代与代更替时表现得最明显。从古生代的最后一个纪（二叠纪）到中生代的第一个纪（三叠纪），化石分布存在着最显著的跳跃，表明发生了生物史上最大的一次灭绝：在古生代大量存在的三叶虫到了二叠纪末期（约 2 亿 2500 万年前）再也找不到，而且 96%的海洋生物物种也都灭绝了。从中生代的最后一个纪（白垩纪）到新生代的第	The fossils turnover phenomena were most obvious between eras. From the last period of the Paleozoic (Permian) to the first period of Mesozoic (Triassic), there was the most obvious jump in fossil distribution, indicating the largest mass extinction occurred: trilobites which were abundant during Paleozoic era could no longer be found at the end of Permian (about 225	

	一个纪（第三纪）的化石分布变化也非常明显，这一次的物种大灭绝规模虽然比不上三叠纪大灭绝，却最为著名：在中生代盛极一时，曾经主宰大地两亿年的恐龙，到了白垩纪后期（约 6500 万年前）完全不见了，同时灭绝的还有大约 70％的海洋生物物种。	million years ago), and 96% of marine organisms were also extinct. From the last period of Mesozoic era (Cretaceous) to the first period of Cenozoic era (Tertiary), the changes in fossil distribution are also very obvious. Although the mass extinction was not as big as the one in Triassic period, it was the most famous nonetheless: dinosaurs which flourished in Mesozoic era and once dominated the earth for 200 million years, completely disappeared in late Cretaceous (about 65 million years ago), along with about 70% marine species.	
IV	生物史上的大灭绝并非只有这么两次。上个世纪 80 年代末的一项研究表明，生物大灭绝在历史上共发生过大约 23 次，大约每 2600 万年发生一次，似乎具有周期性。对于物种大灭绝的发生是否真的如此频繁和有规律，还有争议。但即使是最保守的估计，也认为至少有 5 次物种大灭绝是非常明显的。物种大灭绝即使不是有规律的周期性现象，也是反复发生过的。那么它为什么会反复地发生？	The two mass extinctions are not the only ones. A study conducted in the late 1980s showed that mass extinctions occurred about 23 times, about once per 26 million years, seemed periodic. There are still dispute about whether the occurrence of mass extinction was really so frequent or regular, however, even according to the most conservative estimate, there were at least 5 mass extinctions. Therefore, even if mass extinctions were not regular periodic phenomena, they did occur repeatedly. Why?	
V	恐龙的灭绝最为著名，研究它的人也最多，形形色色的“恐龙灭绝理论”不断地被提出。气候变化、火山爆发是经常被提到的因素。有的恐龙灭绝理论比较有创意，比如说哺乳动物把恐龙蛋吃光了。有的理论则到了荒谬的地步，比如说恐龙是集体自杀的，是被外星人吃光的等等。	The extinction of dinosaurs was most famous, and researchers on the subject are also the most numerous. Many theories of dinosaur extinction have been proposed from time to time. Climate changes and volcano eruptions are the factors mentioned frequently. Some theories are relatively creative, for example, the mammals ate all the dinosaur eggs. Some theories are almost absurd, for example, they say that dinosaurs committed group suicide, or were eaten by aliens.	
VI-1 VI-2	终于，有一个恐龙灭绝理论得到了大多数人的认同。1980 年，曾获诺贝尔物理学奖的路易	Finally, a theory about the extinction of dinosaurs was accepted by most people. In	In 1980, a team of scientists led by physicist Luis Alvarez of the University of California at Berkeley proposed that

VI-3	斯·阿尔法雷兹等人提出，恐龙灭绝是由于一颗小行星撞击地球引起的。这样的撞击爆发出巨大的能量，相当于几十万颗原子弹在地球上同时爆炸，足以引起物种的大灭绝。	1980, Nobel Prize in Physics laureate Luis Alvarez and his colleagues proposed that the extinction of dinosaurs was caused by an impact of an asteroid on the Earth. The impact generated huge energy, equivalent to explosion of hundreds of thousands of atomic bombs on the earth simultaneously, which was enough to cause a mass extinction.	the KT disaster was the direct result of a worldwide atmospheric upheaval triggered by the terrific impact of a huge asteroid or a comet on the Earth. "…the destructive capability of …ten thousand times the entire nuclear arsenal of the world." (p.89)
VI-4	这听上去有点匪夷所思，但是并非空口无凭。	Although it sounds crazy, it is supported by evidence.	If this idea seems like science fiction, it is supported by a good deal of evidence.
VI-5 VI-6	阿尔法雷兹等人发现处于白垩纪和三叠纪边界的岩层含有高浓度的稀土元素。稀土元素在地球岩层中虽然稀少，在陨石中却含量很高，因此这种异常现象表明在白垩纪后期，曾经有一颗大陨石跟地球相撞。	Alvarez et al. found a high concentration of rare earth elements in the rocks at the KT boundary. Although the content of rare earth elements in Earth strata is low, their content in meteorites is very high, therefore this anomaly indicates that in the late Cretaceous period, there was a large meteorite collided with the earth.	To begin with, scientists have found significant quantities of the rare element iridium in the rocks at the KT boundary, not just in one place, but at more than a hundred sites worldwide. …As one such element, iridium is only rarely found in the crust. …Well, asteroids and comets contain quite a lot of iridium…Scientists have also measured the levels of other rare elements in the KT boundary, such as ruthenium and rhodium, and the ratio of their abundance is just as it is in asteroids and comets. (pp.89-90)
VI-7	1990 年，在墨西哥的尤卡坦半岛发现了一个直径长达 180 公里陨石坑，被认为就是那次撞击留下的。	In 1990, a crater with a diameter of 180 kilometers was found in the Yucatan Peninsula in Mexico. It is believed that the crater was caused by that impact.	If that is not convincing, eleven years after Alvarez and his colleagues suggested their impact scenario, another team of scientists discovered an enormous crater in the Yucatan Peninsula in Mexico. …Yet the crater is nearly 180 kilometers across, and in 1992, when it was possible to establish its age, the crater turned out to have been made 65 million years ago. (p.90)
VII-1 VII-2 VII-3	现在已很少有科学家怀疑，在 6500 万年前曾经发生过一次惊天动地的陨石大碰撞。但是，在那个时间段发生过陨石大碰撞不等于就是它引起了物种大灭绝。在其他地质时期也有曾经发生过陨石大碰撞的迹象，但是当时的化石分布却无任何异常。	There are few scientists right now doubt the fact that a huge impact occurred 65 million years ago. However, the occurrence of the impact during that time is not the same as the impact caused the mass extinction. There are evidence showing that huge impacts occurred during other periods, but the fossil record shows absolutely nothing unusual at the time.	The very fact that there is a crater implies that there was a huge impact…But was that enough to trigger a mass extinction?…To make matters even more puzzling, other tremendous impacts in the past haven't seemed to harm anything…The fossil record shows absolutely nothing unusual at the time. (pp.90-91)
VII-4	不少科学家仍然坚持认为火山频繁爆发、气候变化或哺乳动物的兴起才是恐龙灭绝的主要因	Many scientists still believe that the frequent eruptions of volcanoes, climate	In view of these outstanding questions, not everyone believes that the dinosaurs were wiped out by a fatal rock

	素。	changes, and the rise of mammals were the major cause of dinosaurs' extinction.	from the sky. Scientists are kicking around a few other ideas as well. Some years ago the geologist Leigh Van Valen of the University of Chicago noted that the mammals began thriving and increasing their numbers just a few hundred thousand years before the KT mark, and that they could have muscled the dinosaurs out of existence. Some paleontologists suggest that the battle may have been swayed also by changing climate… (p.91) …temperatures or sea levels were rising or falling, volcanoes were erupting,… (p.92)
VII-5	其它的几次大灭绝，我们连发生过陨石碰撞的迹象都难以找到。物种大灭绝是不是还有别的更普遍的因素？	In the other mass extinctions, no evidence of impacts has been found. Were there any other more general factors for the extinctions?	What of the other mass extinctions, 210, 250, 365, and 440 million years ago? For these events, no one has yet found a huge crater of just the right ago. They may do so in the future, but for now most paleontologists suspect that something else was at work. (p.91)
VIII-1	如果我们能够统计各个地质时期物种灭绝的规模，说不定能从中发现什么规律。	If we could count the sizes of extinctions during each period, we might be able to find some clues.	
VIII-2 VIII-3	但是一个物种的化石数量往往非常稀少，对它们进行统计容易造成误差，如果统计属（相似的物种组成一个属）或科（相似的属组成一个科）的灭绝情况，就要准确得多。这是个极为繁琐的工作。	However, the fossils from a certain species are extremely rare, and estimates made based on the sparse record are error-prone. If counting the extinctions of genera (a collection of several closely related species constitutes a genus) or families (a group of related genera constitutes a family), the results would be more reliable. That is a very difficult work.	All told, the effect of a sparse fossil record is to make species seem to originate later and die out sooner than they really did. Fortunately, the errors grow smaller with the presence of more fossils. And that is why Sepkoski, and later Benton, decided not to study species, but to look higher up in the tree of life at the level of genera or families. (p.96) A genus is a collection of several closely related species, and a family is a group of related genera (plural for "genus"). (p.94) Before we see what this wealth of data can reveal, it is worth saying a bit about just how difficult it is to assemble. (p.94)
VIII-4	芝加哥大学古生物学家塞普科斯基在图书馆泡了 10 年，统计化石数量最为丰富的海洋无脊椎动物各个属、科产生和灭绝的时间。	Paleontologist Jack Sepkoski of the University of Chicago stayed in the library for ten years, documenting the origination and extinction of each genus and family of marine invertebrates which have abundant fossils.	Jack Sepkoski of the University of Chicago is a paleontologist who prefers to do his research not in the field but in the library. (p.93) In 1982, Sepkoski published the first installment of his version of the fossil record—a massive database documenting the origination and extinction of many thousands of families…After another ten years of gathering, he had assembled a database for some forty

			thousand different genera (all marine invertebrates) falling into some five thousand different families (with about eight genera in each family). (p.94)
VIII-5	这项工作在 1993 年完成后，又激发了其他人去统计其他类群的古生物的情况。	His work, which was finished in 1993, stimulated other people to document other organisms.	Sepkoski'e efforts stimulated further work, and soon after, geologist Michael Benton of the University of Bristol in England finished compiling an independent database documenting the times of origination and extinction of some seven thousand families of organisms, in this case, both marine and terrestrial varieties. (p.94)
IX-1	把这些数据汇合在一起，计算各个地质时期灭绝的科的数量，不出所料，通常灭绝的规模不大，但是时不时的，会出现灭绝的高峰，最高的 5 个峰，对应着最大的 5 次灭绝。	Plotting these data and counting the number of families went extinct in each geological period, the results were hardly surprising: Usually the extinction was not big, but from time to time, peaks appeared, the highest peaks correspond to the greatest mass extinctions.	As we have seen, the orthodox view on extinction holds that there are two kinds: background extinctions, caused by ordinarily evolutionary processes, and mass extinctions, triggered by climatic changes, asteroid impacts, or other shocks to the biosphere. A rough plot of Sepkoski's and Benton's data seems to back up this point of view. The record of the fraction of families going extinct in each geological period shows a pattern of relative quiet punctuated by sudden cataclysms (SEE FIGURE 7). The tremendous extinctions stand out from the rest. (p.96) [Figure 7 legend: The five largest peaks correspond to the greatest mass extinctions,⋯ (p.97)]
IX-2 IX-3	这样的结果似乎没有什么新颖之处。但是在 1998 年，有两位物理学家换了个角度分析塞普科斯基的数据，统计灭绝规模的分布情况，有了出乎意料的发现：灭绝规模每增加一倍，发生的几率就减少为四分之一。	These results look nothing new. However, in 1998, two physicists analyzed Sepkoski's data from a different angle to see the distribution of extinctions, and they got a surprising discovery: double the size of the extinction, such events become four times as rare.	In 1996, the physicists Richard Sole and Susanna Manrubia took a more careful look at Sepkoski's data and found that the distribution of extinctions according to their size (this being taken as the number of families that went extinct) follows our old friend the power law. In fact, ⋯if you double the size of the extinction under consideration, you find that such events become four times as rare. (p.96)
X-1	这表明生物灭绝和地震、森林大火、沙堆坍塌一样，发生的频率也遵循幂律。	This indicates that the frequency of extinction, like earthquakes, forest fires, and sandpile avalanches, follows the power law.	
X-2	当我们见到大事件时，总是习惯于认定它必然是由某种特殊的原因引起的。	Whenever we see a big event, we are accustomed to think it must be caused by some kind of special causes.	Do violent happenings generally imply violent cause? Must every dramatic extinction have an equally dramatic cause? (p.97)
X-3	但是我们以前介绍过，幂律表明，大事件的发生因素与小事件的发生因素相同，它们的出现纯属偶然，是处于临界状态的系统发生连锁反应的结果，并没有特别的"大"因素（参见《野火烧不尽》，本版 2009 年 9 月 9 日）。当我	However, as we introduced before, power law suggests that the causes for big events and small events are the same, their occurrences are purely by chance, and they are the results of chain reactions by the	We have seen in earlier chapters that this prejudice has taken a beating in recent years—for example, in the context of earthquakes and forest fires. The remarkably simple form of the curve for mass extinctions hints that

X-4 X-5	们挖空心思要为物种大灭绝寻找特别的原因时，是否也误入歧途？也许，全球生态系统和地壳、森林、沙堆一样也处于临界状态，物种大灭绝和背景灭绝的发生因素并无不同，乃是普通的进化过程中一个罕见的，但是自然而然地发生的结果。	systems in the critical state. There are no special “big” factors. (See: The Never Stop Wildfires, this page, Sept. 9, 2009). When we rack our brains to find a particular cause for the mass extinction, are we making a mistake? Perhaps the global ecosystem is in a critical state, just like crust, forest, and sandpiles, the causes for the mass extinction were the same as for background extinction, they were the rare but natural results of general evolutionary process.	scientists may be making a terrific mistake in thinking of these “standout” episodes as something special…The power-law perspective hints that the mass extinctions may not be exceptions to the working of evolution. Rather than the fingerprints of the Hand of God reaching in from afar, they may be the inevitable product of evolution’s most ordinary principles. (pp.97-98)

Notes

[1] See: http://en.wikipedia.org/wiki/2008_Sichuan_earthquake.

[2] Fang's original Chinese: "实际上，目前并没有任何公认的可靠办法可以准确预测地震的发生。根据曾经很流行的复杂性理论，地震的发生是一种复杂现象，涉及很多偶然因素，是无法准确预测的。" (Fang Zhouzi. *Earthquake Experts Shouldn't Be Over-blamed*. XYS20080513. According to Fang's end note, it was written on May 12, 2008. 方舟子：《不应苛求地震专家》, XYS20080513).

[3] Fang's original Chinese: "但是，难以预测并不是不可预测。有时候，对复杂系统的预测能达到令人惊叹的准确程度，……断言复杂系统的突现性质不可预测，必然反对科学传统上对"理论预测－检验"的研究方法的重视，反对探求普遍规律，……"(See: Fang Zhouzi. *Reductionism and Holism*. *Studies in Dialectics of Nature*, Nov. 2000.《还原主义和整体主义述评》，《自然辩证法研究》2000 年 11 期).

[4] For detail, see: Yi Ming. *The Feud between Drs. Fang Zhouzi and Xiao Chuanguo*, Chapter 8, pp.370-400. (《方舟子陷害肖传国始末》370-400 页).

[5] *ibid*. Fang also instigates his followers to scold these scientists with much more vicious and evil words. In July, 2008, Fang set up a special folder to collect these articles, and he labeled the folder "A Group of Demons Celebrate While the Whole Nation Is Grieving." (Original Chinese: "举国同悲日，群魔乱舞时"). See: 《汶川地震事件》.

[6] In January, 2007, Fang wrote: "Who has said all 'earthquake predictions' are 'superstition'? If [I have said] so, it doesn't need Tiandi Shengreng, Seismological Bureau would have eliminated us. What we said was, those who claimed they could predict earthquakes with *I Ching*, astrology were practicing superstition. Can these people represent serious research on earthquake prediction?" (Original Chinese: "又有谁把'地震预测'一概说成'迷信'? 那样的话用不着'天地生人'上场，地震局的人就该把我们给灭了。我们说的是那些号称能用易经、星相预测地震的人是在搞迷信，这些人能够代表正儿八经的地震预测研究？") (See: Fang Zhouzi. *New Century Weekly, a news medium who has no justice, no ability, no morality, no conscience, and no brains*. XYS20070118. 方舟子：《"五无媒体"〈新世纪周刊〉》XYS20070118).

[7] Fang's original Chinese: "现代科学还做不到的事情，伪科学就会乘虚而入，而且不难找到市场。" "这类地震预测术就像算命术一样". See: 《地震预测的梦想与现实》.

[8] The case was made public in March, 2011, in Yi Ming's *Chronicle and Demonstration of Fang Zhouzi's Plagiarism and Copyright Infringement*. (亦明：《方舟子抄袭剽窃年谱》).

[9] 方舟子：《像沙堆一样崩塌》，2008 年 6 月 4 日《中国青年报》。

[10] CCTV. *Is Earthquake Predictable?* June 8, 2008. (中央电视台：《地震能预测吗？》，2008 年 6 月 8 日).

[11] Shenzhen Satellite TV. Can Earthquakes Be Predicted Accurately? May 2, 2010. 深圳卫视：《地震能够准确预测吗？》

[12] Fang's origianl Chinese: "我在哪儿[美国加州]生活了十年。" Note: Fang began living in California in 1997, and since 2002, when he married Liu Juhua, he has been mainly living in Beijing.

[13] Sun Shihong's original Chinese: "所以你们两位，竟然是有一些基本概念都不清楚。方先生有很多基本概念都不懂。"

[14] The two cases are: in September, 2006, Fang's plagiarized British mathematician Drs. John J O'Connor and Edmund F Robertson of University of St Andrews, to write his *The Truth behind a Great Feud in Mathematics History*; in March, 2009, he plagiarized Wikipedia, the webpages maintained by Princeton University and San

Andrews University, to write his *A well-known Case in the History of Science: The Death of Galois*. Fang was unanimously convicted in both cases. See: The Academic Misconduct Assessment Panels: The Verdicts.

[15] See: Yi Ming. *Preface to The Complete Analysis and Comparison of the Plagiarism in Liu Juhua's Master's Degree Thesis*.

[16] Since November, 2010, I have vowed repeatedly to compile one hundred plagiarism cases committed by Fang Zhouzi. (See: 《敬告网友》, 《〈方舟在骗〉序》). At that time, it seemed a mission impossible, but now, it looks a job easily done.

[17] Bakun, WH. and McEvilly, TV. 1979. *Earthquakes near Parkfield, California: Comparing the 1934 and 1966 sequences*. Science, 205:1375-1377.

[18] Kanamori, H. 2003. *Earthquake Prediction: An Overview*. International Handbook of Earthquake and Engineering Seismology, Volume 81B.

[19] See: http://mark.buchanan.pagesperso-orange.fr/about.html.

[20] Buchanan, M. Ubiquity. Crown Publishers, 2000. p.20.

[21] Yang X, Du S, Ma J. 2004. *Do earthquakes exhibit self-organized criticality?* *Phys Rev Lett*. 92(22):228501.

[22] Main, I. 1999. *Earthquake prediction: Concluding Remarks*. Nature Debates; Corral A. 2005. *Comment on "Do Earthquakes Exhibit Self-Organized Criticality". Phys Rev Lett.* 95(15):159801.

[23] Fang's original Chinese: "小学数学没有学好？人教社 2002 年版《数学第六册教师教学用书》：'扩大几倍就是用几乘。缩小几倍就是用几除。'" (See: 2008-06-06, 08:42:26).

[24] Fang's original Chinese: "增加一倍和减少一倍等于不变就是了". (See: 2008-06-06, 15:07:03).

[25] Jia Hepeng, Hao Xin. 2006. *China's Fraud Buster Hit by Libel Judgments; Defenders Rally Round*. S*cience* 314:1366-1367; Hao Xin.2010. *Assailants Attack China's Science Watchdog*. ***Science*Insider,** 30 August 2010; Hao Xin. *Urologist Arrested for Attacks on Chinese Whistleblowers*. ***Science*Insider,** 23 September 2010; Hao Xin. *Doctor Sentenced in Beijing for Attack on Critics*. ***Science*Insider,** 12 October 2010.

[26] Sneppen, K., Bak, P., Flyvbjerg, H., and Jensen, MH. 1995. *Evolution as a self-organized critical phenomenon. Proc Natl Acad Sci U S A.* 92(11): 5209–5213.

[27] Solé RV, Manrubia SC. 1996. *Extinction and self-organized criticality in a model of large-scale evolution. Phys Rev E Stat Phys Plasmas Fluids Relat Interdiscip Topics*. 54(1):R42-R45.

THE PREVIOUS PARTS OF THE OPEN LETTER

Part I: Shameless cover-up

Part II: Shameless "standing-up"

Part III: Shameless make-up

Part IV: Fact distortion and mess-up