Passage through Spacetime

Random Writings of a Physicist

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Tatsuo Tabata

The text pages were prepared with LaTeX (TeXShop); and photogravure pages, with Microsoft Word, both by the author.

Coordinated by Jupiter Corporation, Nakano-ku, Tokyo.
Printed by Poplar Printing Co., Ltd., Shinjuku-ku, Tokyo.

Printed in Japan.

To Teiko, Yuko, and Yasuko

Contents

Preface

This small book consists of three Parts. Part I includes two Chapters, each of which is a series of essays on the Nobel-Prize winning physicist Richard Phillips Feynman (1918–1988). These series were originally written in Japanese for *Noruka Soruka Tsushin* (The Newsletter of the Friends of Tuva, Japan) from 1994 to 1998. In Part II, 39 book reviews written for amazon.com in the years from 2000 to 2004 are collected. These reviews are grouped into eight Chapters according to categories of books. At the amazon.com Web site, the reviews got 90% "helpful" votes (427 out of 472) from customers. As far as I noticed, the editor of customer reviews at amazon.com chose eleven of these reviews as the spotlight review. Part III is my single novella in English. It was written in 1997 and is mainly based on my memory of senior high school days. All these writings have been present at my Web site from five to ten years, and polishing has been made on this occasion of publishing as a book.

The picture on the front cover is my watercolor entitled "The Mountain Village in Switzerland." I painted it wishing that eternal peace be realized all over the world. For the realization of this, we should attach importance to the following words, the sources of which you might guess

easily (answers are given on the last page of this book):

> A. Aspiring sincerely to an international peace based on justice and order, the Japanese people forever renounce war as a sovereign right of the nation and the threat or use of force as means of settling international disputes.
> 2) In order to accomplish the aim of the preceding paragraph, land, sea, and air forces, as well as other war potential, will never be maintained. The right of belligerency of the state will not be recognized.
>
> B. Just as we stood for freedom in the 20th century, we must stand together for the right of people everywhere to live free from fear in the 21st century. And as nuclear power – as a nuclear power, as the only nuclear power to have used a nuclear weapon, the United States has a moral responsibility to act. We cannot succeed in this endeavor alone, but we can lead it, we can start it. So today, I state clearly and with conviction America's commitment to seek the peace and security of a world without nuclear weapons.

I am grateful to Ako Hōki for giving me the chance of writing essays on Feynman. I would like to thank Hiroaki Tahara for providing me with a motive to write "Vicky: A Novella." I am also indebted to Shun'ichi Kawamura for his careful reading of the earliest Web versions of "Vicky" and kind commenting. A summary of *Sanshiro* was inserted in the novella by his suggestion. Sincere thanks are due to Takashi Oshio for his kind and valuable help in making this book.

Tatsuo Tabata
Sakai, Osaka
August 2, 2009

Part I

Hello Mr. Feynman!

Chapter 1

What Little I Know about Feynman

1.1 Puzzles of the Photo

There is a photo of Richard Feynman and other persons on the occasion of his visit to Japan. I did a little thing concerning this photo. I should have done the same thing again, but have failed to do so yet. It is one of the photos in the book *Genius: The Life and Science of Richard Feynman*[1] written by James Gleick (see the first photogravure page of this book). The picture carries the caption, "Feynman and Hideki Yukawa in Kyoto, 1956." There is something strange about this photo. Can you guess what is strange? If you are a Japanese or a Chinese, it is rather easy to find it. Yes! Four Chinese characters on the bulletin board in the background show that the photo is printed backwards.

I knew about this error already ten years before the pub-

[1] Pantheon Books, New York, 1992.

lication of the Gleick's book. It is not that I possess clairvoyant power, but the same photo appeared in the April 1982 issue of the journal *Physics Today* published by the American Institute of Physics. It was also printed there backwards. The article that used the photo was entitled "The Birth of Elementary-Particle Physics," and was written by Laurie M. Brown and Lillian Hoddeson. The caption reads:

> **Hideki Yukawa and Richard Feynman** during Feynman's visit to Kyoto, Japan, in the summer of 1954. Left to right: Mrs. Yukawa, Satio Hayakawa, Feynman, Yukawa, unknown, Minoru Kobayashi. (Courtesy of Satio Hayakawa.)

While writing this essay, I made another discovery. The descriptions of the year in which the photo was taken are different among Gleick's book, the article by Brown and Hoddeson, and another article I will mention later.

In the year that appears in the above caption, i.e., in 1954, I entered Kyoto University. Two years later I attended Professor Kobayashi's lecture course on classical mechanics and Professor Yukawa's lecture course on quantum mechanics. When the picture was printed in *Physics Today*, it was already twenty-eight years since those days. I closely looked the picture with dear memories of my teachers, especially of Yukawa, whom I respected very much, and thus came to the discovery of the backward printing. Around 1982, my interest in Feynman was not so keen as in later years after reading *Surely You're Joking, Mr. Feynman!*,[2] Therefore, my discovery related to Feynman

[2]W. W. Norton, New York, 1985.

was made by the intermediation of looking at the image of Yukawa, who had predicted the existence of the pion as the mediator of the nuclear force.

I am a ready writer. So, on making the discovery, I sent a manuscript to the letters column of *Physics Today*. It read like this: "Professors Lee and Yang would be delighted to find in this picture that the effect of parity operation can be seen from the background Chinese characters in spite of symmetric hair style of Professor Yukawa . . . " A few weeks later, however, I received a letter from the editor, in which he told me that at the time they received my letter they had already arranged to publish the letter from Peter Lee. The galley proof of Lee's letter was enclosed there. The man who beat me by earlier discovery was a Chinese-American working at Lawrence Livermore National Laboratory. It was rather lucky that I was late not in submitting an academic paper but in sending a letter written just for fun.

Peter Lee's letter, printed in the September 1982 issue of *Physics Today*, tells us that he found five clues of inverted printing besides the Chinese characters. One of them is that men's jacket and shirt pockets are on the wrong side. He left the rest as an exercise for the reader. I have never tried to find them. Those who found the rest of the clues, please write it to Friends of Tuva, Japan (FOTJ). A gift . . . would not be offered, but names might be printed on the FOTJ Newsletter.

There is an additional story about the letters column of *Physics Today*. In response to the letter from the editor, I sent him another letter, writing "Thank you for your kind letter, in which you told me that . . . By the way, Lee's

translation of the characters in the photo is not correct; the characters do not mean 'Urgent Notice' but 'Extra Limited Expresses,' announcing a special schedule of the railway during a definite period." Quite unexpectedly, this letter of mine was printed in the April 1983 issue of *Physics Today* under the title, "Chinese vs. Japanese." "The Author Comments" in which Lee expressed thanks to me were printed together.

Now I go back to the backward photo. A more detailed version of the article by Brown and Hoddeson appeared as an introductory article in the book *The Birth of Particle Physics*[3] edited by the authors themselves. In this book we find the photo printed normally. Hayakawa used it in his article entitled "The development of meson physics in Japan." The caption there says that the photo was taken in 1955. This is different from the years in the other captions mentioned above. Which is correct, 1954, 1955 or 1956?

I had been thinking that before the publication of the paperback edition of Gleick's book I should inform the author, or the publisher, of the backward printing of the photo, but I did not do so. In the paperback edition the photo is again printed backward. Therefore, it does not seem that Peter Lee read the hardcover edition and wrote a letter. If I write a letter to the author now, I also have to point out the possible error of the year in the caption. Hayakawa had the original copy of the picture. His description is therefore possibly correct. However, he has passed away, so that we cannot confirm this by asking him. Is there any method to

[3]Cambridge University Press, 1983.

find the correct year?

There was a story of Feynman's visit to Japan in *Surely You're Joking, Mr. Feynman!* But, alas! The year is not written there. Another possible hint is the record of his lecture in Japan. In the list of Feynman's scientific papers we find a paper co-authored with Michael Cohen and published in *Progress of Theoretical Physics*.[4] This is the journal that was edited by Yukawa those days, and the paper seems to prove that Feynman's visit to Japan was 1955. But, wait! The proceedings of the conference are not always published in the same year as that in which the conference was held. I expect someone can check if the above paper is a record of Feynman's lecture made in 1955.

June 1994

Note added later: The other day I browsed the 1955 paper of Feynman and Cohen entitled "The character of roton states in liquid helium" in a library. It is not a full paper presented at a conference, but a letter paper received on August 3, 1955. The following footnote is attached to the first author's name: "Presently visiting Yukawa Hall, Kyoto University. This author wishes to express his gratitude for the kind hospitality he experienced during his visit to Japan." This indicates that "1955" in the caption of Hayakawa's paper is correct.

[4]Vol. 14, p. 261 (1955).

1.2 Interlude

The story by Hippo Family Club, "We Want to See Feynman-*san*" (*san* is a Japanese word to mean Mr. or Ms.), has been being quoted in *Noruka-Soruka Tsushin*[5] [NST; The Newsletter of Friends of Tuva, Japan (FOTJ)[6]]. I find it quite funny and interesting. Its illustrations are cute. In the previous issue of NST a section of the story was printed just on the opposite page of my essay. On reading it, I thought that my essay could not be a competitor against that story in witty touches and funniness.

There is another thing that gave me a shock. I was thinking that in spite of the moderate word "Little" in the title of my series of essays I had much to write about my relation to Feynman. However, it has become clear that "We Want . . . " is going to describe a relation much closer to him than my series. (They wrote that when some members of Hippo Family Club had made a telephone call to him, Feynman-san had replied, "Interesting, . . . interesting." Reading this, I felt like hearing his voice vividly.) Therefore, I have determined to do nothing but to continue writing my essays in my own style of pedantry, wishing only that the readers will not turn their back on me.

[5] "Noruka-Soruka" is the Japanese equivalent of "Pikes Peak or bust" explained in Section 2.2.

[6] You can see a photo of some members of FOTJ in the third photogravure page of this book.

The main mission of our club, FOTJ, would be twofold: (1) exchange between different cultures of Japan and Tuva and (2) remembering Feynman's cheerful and excellent personality in order to learn something useful for us. (I have just resumed pedantic writing.) Feynman was good at talking about difficult problems of physics to laypersons in an easily understandable manner. In other words, he was one of masters to build a bridge over a gulf between the traditional (literary) and scientific cultures, about which C. P. Snow wrote a book, *The Two Cultures and the Scientific Revolution*.[7]

The above thought leads to the understanding that mission (2) is also related to the exchange between different cultures, i.e., physicists' and laypersons' cultures. My essay might often deviate from Feynman, but I would like to make it always relevant to the exchange between cultures in the above two senses or, if possible, in a more general sense.

July 1994

1.3 Feynman Dancing a Jig

I received a letter of thanks from Ako Hōki, the editor of NST, for the manuscript of my previous essay. She wrote that she had been struggling with the Japanese edition of

[7] Cambridge University press, Cambridge, 1959; an extended version, *The Two Cultures and a Second Look*, 1964.

Martin Gardner's book[8] and had finally arrived at the page about Feynman diagrams. She also surprised me by writing that she had read the first Japanese edition of the book when she had been a fifth-year girl of an elementary school. I read the first edition several years after starting my working career. Feeling it too difficult for school children, I never thought of recommending the book to my daughters, who were also elementary-school girls at that time.

A few years ago I bought a copy of the original English version of the third expanded edition of Gardner's book, but have not yet finished it. Reading Ako's letter, I browsed some pages of the book, and found the following fact about which I was forgetting: Feynman appeared in this book in a manner characteristic of him.

Feynman's appearance in the text is briefly introduced in the "Preface to the First Edition" like this: In 1958 a discovery in particle physics was reported. It removed a theoretical difficulty that had long bothered Richard Feynman. The New York Times reported, "Dr. Feynman broke away from a food queue and danced a jig when he heard the news." We can well imagine Feynman dancing lively in excitement. In the preface Gardner also wrote his thanks to Feynman for his reading of the early manuscript and making many good suggestions.

Attached to the last blank page in my copy of the Japanese edition of *The Ambidextrous Universe*, I have a postcard. It is from one of the translators, Chuji Tsuboi, Pro-

[8] *Shimpan – Shizenkai ni Okeru Hidari to Migi*, translated by Chuji Tsuboi et al., Kinokuniya, Tokyo, 1992; the original English edition, *The New Ambidextrous Universe*, W. H. Freeman, New York, 1990.

fessor Emeritus of the University of Tokyo. He politely wrote me thanks for telling him about three or so of errors in their translation. Now my story has just deviated from Feynman, but it naturally and quickly goes back to him. Tsuboi was also the translator of the part on classical mechanics of the Japanese edition of *Feynman Lectures on Physics*.[9]

Most errors in translation happen because of difficulty in understanding a different culture in its broadest sense. I feel happy therefore to find some errors in a book and write about them to the translator to make his or her bridge across two cultures a solid one. Pointing out errors not only in translation but also in original writing has become one of my hobbies. On one occasion, again by Yukawa's mediation, this hobby led me to an episode about another photo in which we find Feynman. I will write about this episode later. Here I like to mention that this continued hobby of mine was stimulated by my pleasure of receiving Tsuboi's postcard mentioned above.

July 1994

1.4 Three Similar Men

Newspapers reported that Julian Schwinger had passed away on July 16, 1994. All the three men who shared the Nobel Prize in Physics in 1965, Sin'itiro Tomonaga, Richard

[9]Iwanami, Tokyo, 1986; original English edition, Addison-Wesley, Reading, Mass., 1963.

Feynman, and Schwinger, are now in heaven. The common cause of their passing was cancer.

Similarities between Schwinger and Tomonaga were described in a memorial talk dedicated to Tomonaga. In the address it was referred that not only their scientific lives had had much in common but also their names included common meaning. The first Chinese character of Tomonaga's first name, sin, has the meaning of "to shake," and the first syllable of Schwinger's last name, Schwing, has the same meaning as this in German. Therefore, the talk was entitled "Two shakers of physics."

I read the transcript of this address some years ago, and remembered only its title vaguely. To write about it here, I looked for the transcript in some of my collection of books for quite a while, thinking that the speaker had possibly been Freeman Dyson, who also made as important contributions to the development of quantum electrodynamics as those made by the three Nobel-winning physicists. The speaker was however Schwinger.[10] One of the "two shakers" himself was the speaker! Only a super-scientist can use such a title.

Tomonaga and Feynman also had a similarity outside the scientific lives. Tomonaga liked *rakugo* (traditional Japanese story-telling that ends in a joke). Feynman was good at mimicking speech in foreign languages. The members of our club, Friends of Tuva, Japan, must well know that one of Feynman's voice tapes *Safecracker Suite* in-

[10]The transcript is published in *The Birth of Particle Physics*, L. M. Brown and L. Hoddeson, ed. (Cambridge Univ. Press, Cambridge, 1983) pp. 354–375; the talk was delivered in Tokyo in 1980.

cludes a piece of his performance entitled "Sensei Samurai (Imitation Kabuki theater)."

August 1994

1.5 The Documentary by Sykes

In NST Vol. 4, there was an appeal for requesting NHK (Japan Broadcasting Company) the broadcasting of a series of documentaries about Feynman made by Christopher Sykes for BBC TV. A book based on this series has been published (C. Sykes ed., *No Ordinary Genius: Illustrated Richard Feynman*.[11] It consists of ten chapters, including more than one-hundred photographs and words of Feynman, his family, friends and colleagues. Chapter 9 is devoted to Feynman's quest for Tuva. This book is surely a required reading for those interested in Feynman and Tuva.

I learned the publication of Sykes's book from *Reader's Catalog*, to which I had just subscribed. For the sake of finding something to write about in this essay, i.e., to increase what little I can talk about Feynman in a manner like locking the garage after the car having been stolen, I ordered a copy of the book to be sent by airmail.

The book on Feynman's unfulfilled adventure, *Tuva or Bust!: Richard Feynman's Last Journey*,[12] gave me a feeling that the passion of the author, Ralph Leighton, is in the foreground rather than that of Feynman. In Sykes's

[11] Norton, New York, 1994.
[12] W. W. Norton, New York, 1991.

book, on the other hand, Feynman himself talks about his eagerness for traveling to Tuva. Near the end of Chapter 9 Feynman says as follows:

> Many explorers like to go to places that are unusual, and it's only for the fun of it, and I don't go for any philosophical interpretation of "our deeper understanding of what we're doing." (Quoted from C. Sykes ed., ibid.)

He also says that thinking about the meaning of what we are doing makes him crazy (in his words, "I'll go nutty"), possibly meaning that such thinking is meaningless. I have to be ashamed of writing about the "mission" of our club in the previous piece of my essay.

August 1994

1.6 The Phone Call

Now I would like to write my trump-card story about the attendance at an international symposium, in which Richard Feynman was also one of participants. Near the end of March 1985, I received a phone call. The person on the other side of the line said, "This is Konuma of Keio University speaking. Did you send a letter to Professor Brown of Northwestern University around the middle of this month?"

He was a well-known theoretical physicist, Professor Michiji Konuma. Saying, "Yes," I was anxious about his next words. He might blame me for sending a rude letter to

Laurie Brown. However, he said, "I have just been to his laboratory. He was very glad to receive your letter, and told me to say his thanks to you on my returning to Japan."

I was quite soothed to hear this. In my letter to Brown, I had pointed out many translation errors and typos in the book, *Hideki Yukawa "Tabibito" (The Traveler)*[13], translated by him and R. Yoshida. Konuma told me the following: Brown had been studying the history of elementary-particle physics in Japan, and made one of his students, Yoshida, translate *Tabibito* into English to use it as one of important sources of his study. Hearing about this, Konuma recommended Brown to publish the translation.

Yoshida possibly moved to U.S.A. in his childhood, or had interest neither in the geography nor in the history of Japan. Thus he gave wrong reading for many geographical and personal names. Brown improved English in Yoshida's translation, but naturally could not correct errors in the reading of Japanese proper nouns. I do not wish to disgrace Yoshida, who played a big role of introducing *Tabibito* to the world together with Brown, but would like to mention a few examples of errors, only to show the difficulty of reading Japanese proper nouns correctly.

In his autobiography, Yukawa mentioned about a priest and poet from Heian to Kamakura era, Saigyo-hoshi (1118–1190), a diplomat of Meiji era, Jutaro Komura (1859–1911), a philosopher of modern era, Kitaro Nishida (1870–1945) and a city in China, Tenshin. Yoshida wrote these names as Seiko-hoshi, Ikataro Komura, Ikutaro Nishida and Amatsu.

[13] World Scientific, 1982.

Except the second, these are surely possible pronunciations. There may be some of you who thought that Yoshida's reading was correct in one or two of these.

October 1994

1.7 Shadow- or Transfer-Pictures?

The phone call from Konuma led me to attend the symposium mentioned at the beginning of the previous section, but I would like to describe a little more about errors in the English translation of *Tabibito* before going into the story about the symposium.

Recollecting his childhood, Yukawa wrote about street-stalls at a fair. He mentioned *utsushi-e* as well as ground cherries and Kintaro wheat-gluten bars among those sold there. In the English version of *Tabibito*, *utsushi-e* was translated as "shadow pictures." I wrote Brown, "*Utsushi-e* means both shadow pictures and transfer pictures, but shadow pictures are not sold but played." I am however not confident about this. In my childhood transfer pictures were popular among children. In Yukawa's childhood days, however, sheets for shadow pictures (the equivalent of present-day slides) might have been sold to enjoy a picture show by passing lamplight through them.

In another place of the English edition, I found the expression, "Schrödinger's unified wave theory." Concerning this, I wrote Brown like this: Schrödinger considered that between the contradictory wave and particle natures

of photons the former, reflecting the continuity of the natural world, was more basic, so that *hado ichigen-ron* here should be translated as "wave monism," which is to be contrasted with the wave–particle dualism that came later. It is rather strange that such an error remained after the check reading by Brown, a historian of physics.

Some days after I got his phone call, I had a chance of visiting Konuma at his office. Then he told me that Brown would attend the International Symposium for celebrating the jubilee of the meson theory to be held in Kyoto in the summer of that year. He also told me that a German professor who stayed many years in Japan was preparing a German version of *Tabibito*.

October 1994

1.8 Kyoto Symposium

The subtitle of the "Kyoto International Symposium" Professor Konuma told me was "The Jubilee of the Meson Theory," and the topic was far from my specialty. However, I decided to attend the symposium to see Professor Brown. It was opened at Kyoto International Conference Hall on August 15, 1985. I went to the site of the symposium early that morning, and was watching the nametag of every overseas scientist coming to the conference room just after registration. Brown also arrived rather early, and I recognized him at once.

During the symposium Brown was very busy in interviewing big names among the participants to collect data for his study of the history of physics, but I could luckily have chances of talking with him twice or so besides the talk of the first morning. Furthermore, the symposium gave me a unique opportunity in my life of seeing Richard Feynman!

Among the participants there were four Nobel-winning physicists, including Feynman. The other three were: Chen Ning Yang and Tsun-Dao Lee, who predicted together that the law of conservation of parity would break down in the weak interactions; and Samuel Chao Chung Ting, who discovered the J/ψ particle. Feynman was the chairperson of the first session on the first day of the symposium.

I also found Michio Nishioka, one of my university classmates and a particle theorist, among the participants. In a coffee break I saw him talking with Feynman, both laughing pleasantly. Afterwards I heard from Nishioka that he had told Feynman about his impressions on the book, *Surely You're Joking, Mr. Feynman!* To my deep regret, I could not do the same, because I had only ordered the book just some days before.

However, my participation in the symposium gave me a joy of being photographed together with Feynman; it was a group photo of all the participants (see the second photogravure page of this book). While Professor Kodi Husimi, who was also a member of the Diet, is seen at the center of the front row in the original photo (the fourth from right in the partial version in this book), Feynman stands rather far from the center in the back row. This

casual position well reflects Feynman's personality.

December 1994

1.9 Borrowing the Title

My contribution entitled "Surely You're Joking, Professor Morinaga!" was published in "Members' Voice" column of *Butsuri* (the journal for the members of the Physical Society of Japan).[14] Of course, it followed the title of the book that had made Richard Feynman famous even among the people unfamiliar to quantum physics. I owe much to Feynman for this borrowing. In that contribution I wrote about the essay written by Professor Haruhiko Morinaga of Munich Institute of Technology. His essay had appeared in the same column shortly before.[15]

Professor Morinaga proposed that institutes for big sciences under the Ministry of Education should be made to belong to the Ministry of Defense. He even recommended changing the names of National Laboratory for High Energy Physics, Plasma Physics Institute and the Institute of Space and Astronautical Science to Beam Weapons Institute, Hydrogen-Bomb Institute and SDI Institute, respectively. [It was still before the end of the Cold War. SDI—Strategic Defense Initiative—was proposed by President Reagan in 1983 to develop laser weaponry in space. As for the US scientists' reaction against this proposal, see

[14]Vol. 41, No. 12, p. 1040 (1986).
[15]Vol. 41, No. 10, p. 852 (1986).

Freeman Dyson's essay, "Star Wars," in *Infinite in All Directions*.[16]

I wrote, "This is an excellent remark of bitter satire against that the Japanese Government have been increasing the defense budget enormously year by year and that they recently determined to join the research on SDI." On the other hand, I also described that his "proposal" had a sensational aspect similar to the old happening brought about by the broadcasting of H. G. Wells's *The War of the Worlds*, which had made many citizens to believe that Martians had actually been invading the earth.[17]

Finally I wrote, "Recently I read the German edition of Hideki Yukawa's *Tabibito (The Traveler)*. Professor Morinaga had written an afterword in this book. Only considering this fact, I was able to reach the conclusion that such a person would never make a foolish proposal in earnest."

By the way, when my manuscript was going to press, a young secretary at the office of the Physical Society of Japan asked me by phone, "Is H. G. Wells not an error of Orson Welles?" She remembered the above happening by associating it not with the author of the novel but with the voice actor who had vividly played the radio drama.

July 1995

[16]Harper & Row, New York, 1988.

[17]The broadcast of "The War of the Worlds" by Orson Welles was made on October 30, 1938.

1.10 *What Do You Care. . . ?*

The title of the second book that tells us again Richard Feynman's fascinating character is difficult to remember compared with his first biographical book, *Surely You're Joking, Mr. Feynman!* Being conscious of my "non-relational relationship"[18] with Feynman, I had to pick out my copy of the second book from the bookshelf to write its title here. However, what made me join the Friends of Tuva was nothing but this book.

The following message is appended to the end of the book, *What Do You Care What Other People Think?*[19]

> A special one-hour audiocassette tape . . . *Richard Feynman: Safe-Cracker Suite* can be ordered by sending a check for $10 to Ralph Leighton, . . . All proceeds go to UCLA's John Wayne Cancer Clinic, whose doctors gave Feynman six additional years of life . . .

I sent a letter of order to Leighton with a check of $12; $2 was added as an estimated shipping fee. For many years after receiving the cassette tape, I was unable to know why its title included the word "suite." One day when I was listening to a Linguaphone cassette tape, the phrase, "Nutcracker Suite" came into my ear. Only then I learned

[18]The title of the original Japanese version of this series of essays is translated literally: "Non-relational Relationship between Mr. Feynman and me."

[19]W.W. Norton, New York, 1988.

that the title of Feynman's cassette tape was so made as to be associated with the title of Tchaikovsky's famous suite.

In my letter to Leighton, dated February 20, 1989, I added the following passage from my habit of pointing out errors: In the story entitled "I just shook his hand, can you believe it?" of the book *What Do You ...*, it is written that Feynman was the honorary chairman of one session of a conference held in Tokyo in the summer of 1986. Was it not Kyoto International Symposium, the Jubilee of the Meson Theory, held in Kyoto from August 15 to 17, 1985? I attended that symposium and saw Feynman serving as a chairman. The first speaker of the session chaired by him was Minoru Kobayashi, Professor Emeritus at Kyoto University. He read a paper entitled "The birth of Yukawa theory" in Japanese, and a young physicist read an English translation after each paragraph. So Professor Kobayashi must have used up his time before coming to the end of his paper to annoy Feynman as told in his story, though I do not remember this point surely.

I concluded that letter with the story told earlier in this series of essays, i.e., the story that I had lost the final chance of talking with Feynman during a coffee break of the Kyoto Symposium.

September 1995

1.11 The Mysterious Letter

In the autumn of 1992, I received a letter from USA. A triangular seal like a postage stamp was put under the sender's address, which read Friends of 'something.' The appearance of the envelope suggested itself to be an invitation letter to a new religion or the like. But why did this come all the way from USA?

Opening the envelope I found two sheets of paper, on both sides of which printing was made with a word processor. The title was "Friends of 'something' Newsletter, Japanese Edition, No. 2." The first heading says, "Dear Friends of 'something' in Japan." It seems that I was already given a membership. The next word is "Ekii!" This is possibly a strange word of greeting. Suspicion in my heart grows further.

All the headings that follow include mysterious 'something,' and refer to Khoomei News, Plan for a Parade, New National Song and Flag, etc. 'Something' seems to be a nation. At the end of the first sheet I find another curious greeting word, "Baiyrlig!"

I browse the second sheet entitled " 'Something' Trader." ... Oh, here is *Safe-Cracker Suite* by Feynman! I noticed at last that Ralph Leighton possibly made me a member of Friends of Tuva by the surplus of the shipping fee I sent for *Richard Feynman: Safe-Cracker Suite*. At that time I had not yet read *Tuva or Bust!* written by Leighton, and

was quite a stranger to that 'something,' which was Tuva. Thus my relation to Friends of Tuva started, and the one to Friends of Tuva, Japan, was to begin later.

December 1995

1.12 Epilogue

These days some overseas publishers of biographical books send me a letter, requesting to fill a form to submit personal data. They say that the data will be accepted for publication when the applicant's activity is regarded to be above a certain standard. I sent the form to Marquis Who'sWho for *Who'sWho in the World, 1995 Edition* without much expecting the acceptance.

The publisher has higher expectancy of selling many copies of the book when they accept the biographical data of more persons. Possibly for this reason, my list of poor activity cleared their review. They seem to publish my biographical sketch also in the 1996 edition, so that I requested them to add an item, "member, Friends of Tuva, Japan." The name of our small club is thus going to be printed in one of international publications.

I began this essay by the story of my finding the photograph of Richard Feynman and others printed backward. I would like to conclude it by another finding. Someone calls our Feynman "an ordinary genius" instead of calling him *No Ordinary Genius* as Christopher Sykes did in the title of his book. "An ordinary genius" is lower in rank than

"no ordinary genius." Are you, an enthusiastic Feynman fan, angry to hear this?

Don't be angry! It is just a typo in the booklet *The Reader's Catalog* to introduce new publications. The book introduced under the title of *An Ordinary Genius* is nothing but the paperback edition of Sykes's book. Richard Feynman must be smiling a sardonic smile in heaven at this typo.

I will continue to write about Richard Feynman under the new and easy-going title of "About Mr. Feynman in Fits and Starts" or something like this. Gentle readers, I beg your generous and invariable favor also for the next series of my essays.

December 1995

Chapter 2

We See Feynman Everywhere

2.1 About This Series

In order not to be obliged to write in every issue of NST, I was thinking to entitle this series "About Mr. Feynman in Fits and Starts." However, Ako, the editor of NST declared that its number of issues per year would be reduced, possibly making the above title an absurdity. There is also the fact that it was necessary for me to translate the previous series into English. I have therefore come to think it appropriate to give this series such a new name that might be easily translated into English. Thus the present title has been adopted.

The title of the English version of the previous series, "What Little I Know about Feynman," is a free translation of the original Japanese title, a literal translation of which would be "Non-Relational Relations between Mr. Feynman and Me." "What Little" comes from one of my favorite

books *What Little I Remember*[1] written by Otto Frisch, who is a physicist born in Austria and is known by the first use of the term "nuclear fission." His "Little" is full of wit, but my "Little," needless to say, has its literal meaning only.

The title of the present series also includes a little bit of resistance to the editor's words written in the previous issue of NST: "Considering from the nature of our club, it is necessary for us to collect new stories about Feynman and provide these to the members. However, Feynman himself is not living now, so that it is difficult to get such stories."

Reading books on physics or science in general, we very often find the name of Feynman. If we try to learn something from his curious mind on such occasions, new stories about Feynman would be born. Though I say this big thing, I am not sure if I can tell you a lot of new Feynman stories. This series might end up writing only commonplace comments on some books in which Feynman appears. Anyway, I will start to write, and expect to hear criticisms from readers.

June 1996

2.2 The Origin of *Tuva or Bust!*

The preliminary issue, numbered Volume 0, of NST had also an English title. The title included a word wrongly

[1] Cambridge University Press, 1979.

borrowed from the title of the book *Tuva or Bust!* The book, written by Ralph Leighton, describes Richard Feynman's planning for his last adventure. I wrote to Ako Hōki, the leader of FOTJ and editor of NST, that the title of Leighton's book was not *Tuva or Burst!* but *Tuva or Bust!* Then she removed the English title from its first issue. I am therefore responsible for the disappearance of the English title. In the first issue, Ako cited my letter to her together with the explanations of the words "burst" and "bust" taken from an English-Japanese dictionary. The explanation for "bust" included a phrase, "Pikes Peak or bust," the meaning of which was given as "to accomplish one's aim by overcoming every difficulty." I guessed that the title of Leighton's book was based on this phrase, but was unable to understand what Pikes Peak was.

The other day, I thought of asking Robb about the origin of *Tuva or Bust!* and sent him an e-mail message. Robb – Robert M. Wade – is the creator of the Web site called The Tuvan Hillbilly's site. This site was introduced in NST Volume 14, but the URL printed there had a typo. I tried everything to get access to the site, and found Robb's e-mail address. He is one of the persons to whom I sent the English version of the first chapter of "What Little I Know about Feynman."

Robb promptly responded me with a long message. Before quoting it, I would like to write how he has become interested in Tuva and Richard Feynman. From 1990 to 1992, Robb lived in Moscow and worked as a painter of the American Embassy. Here a painter means not an artist who draws pictures but a worker who paints houses, rooms,

etc. I confirmed this by asking Robb, who wrote me, "I was capable of painting in one color (usually white)." One of Robb's good American friends, who also worked there, was given a copy of *Tuva or Bust!* by a friend of his before coming to Moscow, and was told that he should visit Tuva during his stay in Russia. Robb borrowed the book and read it, becoming fascinated by Tuva. Robb's friend wrote a letter to Ralph Leighton, and was told the telephone number of a lady, Rada Chakir, who lived in Tuva and had helped Ralph make his trip. By her aid, Robb and his friend were able to arrive at Kyzyl, the capital of Tuva, after hard traveling from Moscow to Tuva. Luckily the second international symposium on Khoomei (Tuvan throat singing) was in progress at that time, and Rada arranged tickets to the last performances. They also enjoyed looking at a traditional wrestling match and beautiful countryside.

After seeing a paradise in this trip, Robb's life has been changed. Returning to United States, he went back to the university and finished his Bachelor's degree in Russian, and completed a Master thesis under the title of "Animal Imagery in the Tuvan Shamanic Healing." Thus his interest in Feynman started from *Tuva or Bust!* and he also read other books of Feynman. He especially likes Feynman's accounts of safe cracking.

I quote below Robb's e-mail message on the origin of the title *Tuva or Bust!* by his permission.

> Monday, 22 January 1996
>
> Hi Tatsu,
>
> I am more than happy to explain the phrase "something or

bust." I often explain it to Russian friends of mine, so I have the whole explanation well memorized.

One of the meanings of the word "bust" is "to ruin financially" (Webster's New Collegiate Dictionary, 1979). In the last century, when pioneers were heading from the Eastern portion of the United States to settle the then "Wild" west, many would put signs on their wagons which would read "(destination) or bust"—example: "California or Bust," "Oregon or Bust." For many of these settlers, the move out west was a desperate gamble for them, for they were leaving family, friends, and all that was familiar in the hopes for a better future for themselves and their families in the West. The phrase displays not only an understanding that failure to reach the intended destination could mean total ruin, but it also reveals something about the spirit of the settler—their willingness to attempt a journey into the unknown even though the prospect of failure was imminent.

This phrase became popularized again in America in this century during the Great Depression of 1929. Many poor farmers from the central states of America, such as Oklahoma, were caught not only in the middle of the Depression, but also in the middle of a terrible drought, which threatened many with starvation. Thousands of these farmers packed up all of their meager belongings and headed out to California, where they had heard about prospects of available jobs and fertile farmland. Like their ancestor before them, they once again would hang banners on their old cars and trucks saying "California or Bust." Again, meaning they would reach their destination "or die trying," as a popular synonym states.

So you can see, this phrase is not really at all out of character for Richard Feynman, who tried to reach Tuva "at all costs." The only tragedy is that like so many of his travelling predecessors, he did not reach that final destination. I like to think that his efforts did not go in vain, for he opened the way to Tuva for his many fellow travelers.

> Tatsu, I'm sorry this is such a long explanation, but I thought you might find it interesting (I know I certainly do). I hope you enjoy it.
>
> Robb

I should be happy if you also enjoyed reading Robb's explanation of the origin of "something or bust."

November 1996

Note added later: An invitation letter of an academic conference to be held in Denver, Colorado, arrived at me wrongly (and fortunately). It included this explanation: "The Pikes Peak (14,110 feet) is known as the Summit of America, and offers the world's highest railroad system. 'Pikes Peak or bust' must be the phrase made before the railroad system was built."—We happen to learn something from an unexpected source.—

2.3 Feynman in *Nano!*

"Hello Mr. Feynman! I'm surprised to see you here in the book *Nano!*[2]" The author of the book is Ed Regis, who also wrote *Who Got Einstein's Office?*[3] The book describes a story centered on Eric Drexler's thought and activities to construct machines that manipulate matter at the molecular level.

[2]Bantam, London,1995.
[3]Addison-Wesley, Reading, Mass., 1987.

On December 29, 1959, Feynman delivered the lecture entitled "There's plenty of room at the bottom: An invitation to enter a new field of physics.[4]" Here "the bottom" means the lowest end of the scale, namely the micro-world. Considering that Feynman was the first person to present the idea of such technology, it was no wonder to see him in *Nano!*

At the end of this lecture, Feynman proposed to offer two prizes of $1,000 each. One is to the person who first takes the information on the page of a book and put it on an area 1/25,000 smaller in linear scale to be read by an electron microscope. The other is to the person who first makes an operating electric motor of only 1/64-inch cube. Feynman expected that claimants for such prizes would appear rather soon. The expectation was right, and he had to pay for the prizes without waiting long (a 1/64-inch square motor in 1960 and a scale reduction of 1/25,000 in 1985). To commemorate this, the $10,000 Feynman Prize in Nanotechnology is now provided.

In Regis's book, descriptions are given of Chris Petersen, who studied at the Massachusetts Institute of Technology (MIT) and married Eric Drexler. She never did like physics at MIT, and explained the reason as follows: Even at MIT, physics teachers were of bad quality. One day, she went to the California Institute of Technology (Caltech) to visit a friend there, and they attended an informal question-and-answer session led by Richard Feynman. Then she thought, "If I could just learn physics from this man!" Finding the

[4]The transcript of this lecture is available at the following Web site: http://www.zyvex.com/nanotech/feynman.html

words of praise for Feynman's excellent lectures on physics was also out of my expectation in reading the book on nanotechnology.

In *Nano!* we also read about Feynman's son, Carl. In January 1981, Eric Drexler gave a series of lectures on molecular-scale devices at MIT. At the beginning of the talk, he asked if anyone in the audience had ever heard of an idea like this. Then a young guy in the back raised his hand and said, "Well, a talk by Richard Feynman in 1959." Drexler said, "Yes, that's the first citation in my paper. Anyone else?" No. So he went on with his lecture, but the guy turned out to be Carl Feynman afterward.

A similar anecdote about a great physicist and his son, who talked about his father's thought, is found in John Horgan's book *The End of Science*.[5] The American theoretical physicist John Wheeler has the faith that humans will one day find The Answer to describe not only the final theory of physics but also the secret of life and the solution to the riddle of the universe. However, his mentor Niels Bohr had the opposing thought. Wheeler learned of Bohr's view not directly from the great man but from his son only after Bohr's death.

Now let us return to *Nano!* Eric had become friendly with Carl after that lecture, and had invited him to parties. One night Carl came with his father. Eric recalled this: Being embarrassed to say, "This is Richard Feynman," he introduced Feynman as "Richard." Why was Eric embarrassed? I thought the reason to be that Eric, as the host of

[5]Addison-Wesley, Reading, Mass., 1996.

the party, had been forced to introduce Feynman in spite of the fact that the latter had been well known by all the guests. However, this was not the case. Regis writes that one of the guests, Kevin Nelson, who had enjoyed talking with Feynman, thought him to be "some kid's father." Thus the reason must have been that receiving the visit of an important person, Eric was at a loss how to treat him.

There is another story about Feynman in that party. Nelson recalls that Feynman talked about Eric's molecular device, "That's simple stuff. Why doesn't he work on something different?" This is a remark only a no-ordinary genius can say.

February 1997

2.4 Feynman's Tall Order

Some of Japanese physicists, Torahiko Terada and Ukitiro Nakaya for example, are also known as a good essayist. The Nobel-winning physicists Hideki Yukawa and Sin'itiro Tomonaga also produced appealing writings. Fumiko Yonezawa, who was the first lady President of the Physical Society of Japan, recently published her second collection of essays. I, a humble physicist, am enjoying writing essays on Richard Feynman, too.

I had been thinking such a relation between physicists and essays to be a phenomenon peculiar to Japan. These days, however, there are also good essayists among American theoretical physicists. Examples are Hans Christian

von Baeyer and Alan Lightman. The former is the recipient of the Science Journalism Award of the American Association for the Advancement of Science. The latter teaches the technique of writing besides physics at MIT, and published two novels, *Einstein's Dream*[6] and *Good Benito*.[7]

Each of 17 essays in Baeyer's book, *The Fermi Solution*[8], though being a slim book of 172 pages, teaches us various aspects of physics, from experimental to theoretical, and from particle to solid-state physics, and includes the author's light and witty comments. Lightman's *Dance for Two*[9], also a thin book of 169 pages, consists of 24 selected essays of wide variety: physicist's eye description of a scene, easy introduction to physics and its history, a criticism of the science policy and short science fiction stories.

In the essay entitled "Nothing but the truth" in *Dance for Two*, Lightman gives a recollection about Richard Feynman. Lightman first writes as follows: Writers and artists modify their direct experiences in their works to fit their purposes. Similarly, scientific facts cannot simply be understood without appropriate interpretation of experimental results. Thus personal prejudices happened often in the history of science.

As an example of misleading interpretations, Lightman writes about a three-page paper, "On the theory of stars," published by the famous physicist Lev Davidovich Landau in 1932. Landau theoretically studied the balance of inward

[6]Pantheon, New York, 1993.
[7]Pantheon, New York, 1994.
[8]Random House, New York, 1993.
[9]Pantheon, New York, 1996.

gravitational forces against the outward quantum mechanical pressure in burnt-out stars and got the result that such stars would suffer complete inward collapse if slightly more massive than the sun. Considering that this result was contradicted to the observed facts, Landau concluded that the laws of quantum mechanics were violated. He was lead to the wrong conclusion because he did not notice that the stable massive stars observed were not the burnt-out stars his calculations applied to. Even the great Landau was fooled by the result that was so disturbing to common sense but could have been one of the first predictions of the existence of black holes.

Lightman's another example in theoretical physics is the following famous story: In 1917 Albert Einstein modified his 1915 theory of gravity in an ad hoc manner, because it predicted a dynamic universe in contradiction to the then held static nature of the universe. However, Einstein repented the modification in 1929, when Edwin Hubble found observationally that the universe was expanding.

Further examples are taken from experimental physics, i.e., Joseph Weber's report on the first detection of gravitational radiation in 1969 and Buford Price's announcement of the evidence for the detection of magnetic monopoles. Both of these results were not confirmed by more sensitive measurements made later. Lightman concludes his story with Richard Feynman's commencement address given to future scientists. The address is summarized as follows: "When we do scientific research, when we publish our results, we should try to think of every possible way we could be wrong." Lightman adds, "His words hovered in the thick

air, blending with the various ambitions and beliefs gathered there. It was a tall order."

"The discovery of cold fusion" announced by Martin Fleischmann and Stanley Pons in 1989 is one of the latest cases in which the scientists lacked the consideration of Feynman's tall order.

February 1997

2.5 Scientists' Required Reading

Richard Feynman gave a course at Caltech called "Potentialities and Limitations of Computing Machines" from 1983 to 1986. The lecture note of this course was published as a book entitled *The Feynman Lectures on Computation*.[10] One of the editors, Anthony Hey, writes in the foreword as follows:

> Although the lectures were given some ten years ago, much of the material is relatively 'timeless' and represents a Feynmanesque overview of some standard topics in computer science ... His philosophy of learning and discovery also comes through strongly in these lectures.

Not a few persons would wonder why the theoretical physicist Feynman gave the lectures on computation. I was one of such persons. Feynman's interest in computers began in the years when he joined the Manhattan project as a

[10] Anthony J. G. Hey and Robin W. Allen ed., Addison-Wesley, Reading, Mass., 1996.

youth before getting Ph.D. This story is written in the section "Loss Alamos from Below" of the book *Surely You're Joking, Mr. Feynman!* He was the leader of the IBM group to calculate the energy release during the bomb's implosion by the method of "parallel computing" in the present terminology.

Hey gives an afterword in "The Feynman Lectures on Computation"; it is entitled "Memories of Richard Feynman." The same article was also published in *Physics Today*.[11] In this article Hey writes, "Feynman's Nobel Prize lecture should be required reading for all aspiring scientists." Note that he does not say "physicists" but "scientists." I have been idle and have never read Feynman's Nobel Prize lecture, but wish to read it in the near future to find why it is required reading.

Hey also refers to the other piece of required reading for students of all disciplines. It is Feynman's article on "Cargo Cult Science." A modified version of this article was published as the last story of *Surely You're Joking, Mr. Feynman!* Hey explains that it was originally Feynman's commencement address to new Caltech graduates in 1974. This may be the same address as the one Alan Lightman referred to (see the previous section).

May 1997

[11] Vol. 49, No. 9, p. 44 (1996).

2.6 "Cargo Cult Science"

I was curious about what was the title "Cargo Cult Science" in the Japanese edition of *Surely You're Joking, Mr. Feynman!* So I browsed the Japanese edition at a bookstore, finding that the translator Masako Onuki only used the phonetic copy in Japanese characters of the English words. At the place of its first appearance, she also wrote a Japanese phrase that means "science believing in cargoes" in parentheses.

I have thought of the translation *Chakuni Negai no Magai-Kagaku* (pseudoscience hoping the arrival of cargoes). In the original title, "cargo" and "cult" alliterate. This is converted into an end rhyme between *negai* (hoping) and *magai* (pseudo) in the translation. I flatter myself that I have done well in this translation. (In fact, it has come into my mind without much pondering.)

The title "Cargo Cult Science" comes from the following story: It happened on a southern island, which had been used as a transit base of the air force during the war. The people of the island got the benefit of good materials from airplanes landing there. After the war they wanted the same thing to happen and made an apparent copy of runways, fires along the sides of these and a wooden hut for a control person with headphones and antennas (made of wood and bamboo). The form was perfect, but it did not work because of the missing of something essential. Feyn-

man called this fake situation "cargo cult science."

Feynman says that what is missing in cult cargo science is a kind of scientific integrity. When I was writing the Japanese version of this essay, I stopped writing at this point for a few days to find a good Japanese word for integrity. Then I found an interesting poster of a labor-information magazine in the commuting train. The title of an article in the advertised issue included the English word of "integrity." The topic of the article was features necessary for the technical employee in coming years, and the Japanese translation given there for integrity was *ikkansei* (consistency). This seemed to me to contradict another important feature the author mentions, double career, to some extent.

Feynman gave the following example for integrity: "If you're doing an experiment, you should report everything that you think might make it invalid." Thus Feynman's "integrity" is considered equivalent to honesty. Onuki gives two words in her translation, one of them in parentheses: *ryoshin* (*keppekisa*) [conscience (fastidiousness)]. Both of these words are rather similar to honesty.

It sounds a little strange to say that the people of the southern island lacked honesty when they made their contrivances. From our viewpoint, however, their works were false things. Therefore, they were cheating themselves unconsciously owing to their scientific illiteracy. Namely, they were scientifically dishonest without noticing it.

Scientists should not be dishonest either consciously or unconsciously. Not to be dishonest consciously is partly the matter of moral. To avoid being dishonest unconsciously,

scientists have to be well trained in their subject.

May 1997

2.7 Feynman in *The Golem*

Feynman's advice in the same line as his talks described in the previous sections "Feynman's Tall Order" and "Cargo Cult Science" can also be found in the book *The Golem: What Everyone Should Know about Science*[12] written by Harry Collins and Trevor Pinch. The golem in the title of this book is a creature of Jewish mythology, a human-shaped being made by man from clay and water. It becomes stronger and stronger day by day, follows orders, does his master's work and protects him from the enemy. The golem is however clumsy and dangerous, and may kill the master with vigor.

Collins and Pinch compare the golem to science. Using case studies, they explain the following: All the results of scientific experiments do not allow us a clear-cut interpretation, but a definitive interpretation is mostly established only after different opinions are weeded out on the basis of good theories and judgments. The case studies range from the experimental confirmation of the theory of relativity to the sex life of the whiptail lizard. Among those episodes, the one that includes Feynman's words appears in the last chapter on the missing solar neutrinos.

[12]Cambridge University Press, Cambridge, 1993.

The source of solar energy is the nuclear fusion reaction. As a result of this reaction, sub-nuclear particles called neutrinos are produced, and some of them come to the earth. Neutrinos have no electric charge and zero or very tiny mass, so that they interact with matter scarcely. This makes it extremely difficult to detect them. Ray Davis's group at Brookhaven National Laboratory tried to detect solar neutrinos for twenty years and got the first results in 1967. The results indicated a very low flux of neutrinos compared with the theoretical prediction made by John Bahcall, who was then a post-doctoral student at Cal Tech.

Bahcall initially co-operated with Davis's group for the experimental project, so that he tried to correct the theoretical value as much as possible by replacing the input data by new ones in order to show that the theory was consistent with the experiment. Richard Feynman said to him, "You did nothing wrong. If there is a contradiction, it makes the result more rather than less important." The authors of *The Golem* write that it seems to have been good advice and that Bahcall has managed to continue to make a career out of solar neutrinos by stressing the scientific importance of the problem.

Bahcall's career did not suffer from the conflict between the experimental results and the theoretical prediction; he won prizes for his work on solar neutrinos and got the highly prestigious post of Professor of Astronomy and Astrophysics at the Princeton Institute for Advanced Study. This is one of the stories that indicate the excellence of Feynman's advice. As for the conflicting results of the solar neutrino flux, the authors write in "Postscript 1992"

that negotiations were still in progress.

November 1997

2.8 Feynman in *The End of Science*

In the section entitled "Feynman in *Nano!*" I mentioned the book *The End of Science* written by John Horgan. An article just like a summarized version of the book was published in the "Back Page" column of *APS News*.[13] This column always carries such an article that evokes discussion about the relation between physics and society. In his article Horgan quotes Feynman's words to support his own argument. So I would like to give a summary of the summary here.

The title of Horgan's article is "Is science a victim of its own success?" First, he describes about various situations that make funding for basic research difficult as well as different limits brought about by the advancement of science itself. He insists that in spite of these the greatest threat to science's future is its past success. Then he anticipates that in science at its purest and grandest, i.e., in the primordial human quest to understand the universe and our place in it, further research may yield no more great revelations or revolutions but only incremental, diminishing returns. The vast majority of scientists would be content to fill in details of the great paradigms laid down by their predecessors.

[13]Vol. 5, No. 11 (1996).

There would be some ambitious scientists who want to create revolutions in knowledge analogous to those triggered by Darwin's theory of evolution or by quantum mechanics. However, they have to rely on the method of speculative, non-empirical mode. Horgan calls it ironic science. Ironic science, he considers, might offer points of view interesting and provocative but does not converge on the truth.

As an example of ironic science, Horgan refers to superstring theory, which for more than a decade has been the leading contender for a unified theory of physics. Superstring theory posits that all the matter and energy in the universe and even space and time stem from infinitesimal, string-like particles wriggling in a hyperspace consisting of 10 (or more) dimensions. Unfortunately, probing the realm of superstring directly would require an accelerator 1,000 light years around. This problem led the Nobel laureate Sheldon Glashow of Harvard University to compare superstring theorists to "medieval theologians."

Next, Horgan describes an counterargument opposing to some optimists who asserts science's boundless possibilities, and cites the following words of Richard Feynman: "The age in which we live is the age in which we are discovering the fundamental laws of nature, and that day will never come again." These words are taken from *The Character of Physical Law*.[14] Horgan concludes as follows:

> Modern science has left many deep questions, which will probably never be definitively answered. These unanswerable questions give rise to superstring theory and other ironic theories. Ironic science, like great literature or art

[14]BBC, London, 1965; MIT Press, Cambridge, Mass., 1967.

> or philosophy, can ensure that we retain our sense of wonder before the mystery of the universe, but cannot give us the truth.

Four comments submitted against Horgan's article and his reply to them were published in later issues of *The APS News*. I will introduce you to them in the next section. We will also read Feynman's other words there.

November 1997

2.9 Feynman Drives Out Feynman

One of those who submitted counterarguments against Horgan's view to *The APS News* is Gordon Kane. He is Professor at the University of Michigan and the author of the book *The Particle Garden*.[15] He writes, "In fact, it is a myth that string theories or ideas formulated at the Planck scale cannot be tested." Then he describes examples of the facts in which theories were tested indirectly. (He also published a paper about such examples in *Physics Today*.[16])

More interesting counterargument is the one written by F. R. Tangherlim of San Diego, California. To insist that we should not trust Feynman's words cited by Horgan, he quotes Feynman's words from another source: "Since then I never pay any attention to anything by 'experts.' I calculate everything myself." The source is the essay "The

[15] Addison-Wesley, Reading, Mass., 1995.
[16] Vol. 56, No. 2, p. 40 (1997).

7 Percent Solution" in *Surely You're Joking, Mr. Feynman!* Tangherlim writes: In the quotation used by Horgan, Feynman is speaking as an "expert," whereas in the above quotation, he is speaking as a practicing scientist, par excellence. The moral for practicing scientists is that they should not pay any attention to the first quotation, but pay close heed to the second.

I am one of the persons who thought that Horgan's view is difficult to accept, although I found his book *The End of Science* interesting as the record of interviews with many famous scientists. A critique against Horgan's book also appeared in *Butsuri* (The journal for the members of the Physical Society of Japan).[17] The author of the critique, Akira Hasegawa severely writes that the book was the most tedious and meaningless among those he has read these years.

Horgan's reply letter to the four counterarguments was published in the next issue of *The APS News*[18]; it does not seem to include proper answers. Against Tangherlim's opinion, he uses this logic: Sheldon Glashow says that empirical data is important in modern physics; Glashow is just an "expert"; and thus Tangherlim can ignore Glashow and the importance of empirical data.

Tangherlim does not say that empirical data is not important. Using his attachment of importance to the second quotation from Feynman, however, Horgan derived his ignoring of empirical data. While being a little foxy, this is a witty logic, isn't it?—It is deplorable that such keen and

[17]Vol. 52, p. 711 (1997).
[18]March 1997 issue.

witty debates can rarely be seen in academic journals in Japan.—

June 1998

2.10 The Mirror Puzzle, Tomonaga, and Feynman

The previous series of my essay about Feynman began by a story about a backward photo, namely, a photo in the mirror-reversed appearance. In relation to this, I wrote that Ako had read the Japanese edition of Martin Gardner's book, *The Ambidextrous Universe*. The idea for the present piece of essay was already born at that time, because the first chapter of Gardner's book treated the puzzle about the left-right reversal by a mirror, i.e., "Why does a mirror reverse left and right?" The idea becomes a real piece at last.

Sin'itiro Tomonaga, who won the 1965 Nobel Prize for physics with Julian Schwinger and Richard Feynman, wrote the book entitled *The World in a Mirror*.[19] The book includes an essay with the same title as the title of the book. In that essay Tomonaga writes about a discussion made among his colleagues and him at RIKEN (the Institute of Physical and Chemical Research) in his young days. The theme of the discussion was the mirror puzzle. Feynman

[19]Misuzu Shobo, Tokyo, 1965, in Japanese.

also talked about this puzzle in his student days.[20] However, these would-be Nobel laureates could not find the definitive solution to the puzzle.

I found it strange that Tomonaga wrote about "psychological space" in his essay, and thought it much stranger that physicists were unable to find the answer to the mirror puzzle. They should be well informed of the mirror reversal to learn the inversion of a coordinate system or the parity operation in physics. Tomonaga concluded his essay with the words that he would like to hear clear-cut solution to the mirror puzzle. So I sent a letter, in which I wrote my explanation of the mirror reversal and which was addressed to Tomonaga, to the publisher of his book, Misuzu Shobo.

I did not much expect to get a reply directly from Tomonaga. This might be proved by the following words in my letter: I should be happy if you write about some better explanation when you are requested to write an essay by one of bothering publishers. (It was just after his winning of the Nobel Prize.) I only supposed that my letter might appear in an issue of the advertisement leaflet published by Misuzu Shobo. However, nothing happened to my letter, and Tomonaga passed away in July 1979.

On March 12, 1985, the question-and-answer column of the evening issue of the Asahi Shimbun carried an article to tell the arrival of a question from a reader about the mirror puzzle. The editor wrote about the books written

[20] Feynman's "answer" to the mirror puzzle is described in James Gleick's *Genius*, but it was wrong in view of later academic papers on the puzzle. See also "Note added to the book version" at the end of this section.

by Gardner and Tomonaga, and concluded that he wanted readers to tell him a more understandable explanation. I sent a manuscript to the editor writing a simpler version of the explanation I had sent to Tomonaga. Some of readers' contributions (it was reported that the total number of contributions amounted to 186) were reviewed in a rather wide space of the evening issue dated April 16, 1985. My explanation did not appear there, but I received from the editor a polite letter of thanks, which told that they fully studied my manuscript for their benefit.

Note: Just after I started preparing this piece of essay, Yohtaro Takano published the book, *Mystery in the Mirror*,[21] in which he proposed the multi-process hypothesis for the mirror puzzle.[22]

June 1998

Note added to the book version: The Web version of this section written in Japanese includes further story about the mirror puzzle (it was not included in NST because of ceased publication). However, it only tells about my thought before our publication of academic papers on the puzzle.[23] So I will write more complete story about the mirror puzzle elsewhere.

[21] Iwanami, Tokyo, 1997.

[22] An academic paper on the hypothesis has also been published: Y. Takano, Psychonomic Bulletin & Review Vol. 5, p. 37 (1998).

[23] T. Tabata and S. Okuda, ibid. Vol. 7, p. 170 (2000); H. Yoshimura and T. Tabata, Perception Vol. 36, p. 1049 (2007).

Part II

Book Reviews

Books Reviewed in Author's Alphabetical Order

In the following review pages, a set of symbols before the book title, ⋆⋆⋆⋆· for example, shows the result of the present author's evaluation of the book, five stars representing the highest mark.

Fiction

A Philosophical Novel

⋆⋆⋆⋆· **Zen and the Art of Motorcycle Maintenance: An Inquiry into Values.**
By Robert M. Pirsig. *William Morrow, New York, 1974; 25th anniversary edition, 1999 (paperback).*

A Japanese biologist wrote about this book in a Japanese magazine as follows: Many years ago when she was studying in England and going to buy a motorcycle, one of her colleagues recommended this book to her, but it was not really a book on motorcycle maintenance but a book that taught philosophy in a simple manner. She liked this book and read it repeatedly.

Reading the above story and finding that the twenty-fifth anniversary edition of this book was published in paperback, I bought a copy and began to read it, expecting to learn something about philosophy or the history of philosophy. To some extent, this expectation made me read the

book quickly in an effort to get to possible chapters where the teaching of philosophy might be fully given. Even without such a motivation, however, one could read this book speedily, because the story magically enchants the reader and because the style of Pirsig's writing is very readable even to the non-native speaker of English who, like me, has read only a small number of novels in English.

Surely, descriptions of classical philosophies and contemporary philosophical problems are given in parallel with the story of motorcycle traveling. However, I have found that this is essentially a novel, which invokes ideas about the reunification of art and technology and about the quality of life. The great point of the book is that it can also be entertained as a book on philosophy, though descriptions of ancient Greek philosophies in later chapters are not very understandable. In the last chapters the story of a relation between a father and his son reaches a moving climax.

November 11, 2000

Good for Would-Be and Working Scientists

⋆⋆⋆⋆· **Eater.**
By Gregory Benford. *HarperCollins, New York, 2000.*

Gregory Benford, a professor of physics at the University of California, Irvine, provides an educational, rather than en-

tertaining, sci-fi story. Actually, he writes in the afterword of this book, "I have endeavored to show ... how scientists do think, work, and confront the unknown." The present reviewer is a physicist. So he enjoyed how the physicist-writer well expresses scientists' thinking, working, and loving. However, the reader who is a sci-fi aficionado but is a layperson of science might find the long descriptions of scientific discussion by the characters a little tedious or difficult to understand. The author also gives satirical descriptions of politics and politicians. Educational and satirical descriptions are elements not of sci-fi but of purely literary novels. Thus the author seems to be writing for a genre partly unsuitable for his talent.

The story begins when Benjamin Knowlton and his wife Channing, both working at an astronomical center in Hawaii, find a strange interstellar object. It is identified to be a black hole approaching Earth, and the name "Eater" proposed by Channing is adopted. The British astronomer Kingsley Dart joins the center. Channing, formerly a brilliant astronaut and now having a heavy cancer, and Kingsley feel an attractive force between themselves. The Eater has intelligence stored in its magnetic field, and sends messages to Earth to demand its "remnants." Channing makes up her mind to ... You will like this book very much, if you are a romantic scientist or hope to be one.

February 14, 2002

An Intelligent Novel

⋆⋆⋆⋆⋆ **Galatea 2.2.**
By Richard Powers. *Harper Collins, New York, 1996 (paperback); originally published in 1995 by Farrar, Straus and Giroux.*

Before buying this book, I read a review of the Japanese edition of the book, and thought that even I, a non-native speaker of English, should be able to read its original English edition rather easily because of the following reasons: (1) The author Richard Powers studied physics before becoming a writer, and I am a physicist. (2) This is a scientific novel about artificial intelligence. In fact, this book has very rich contents more than computer-based neural networks, and full understanding requires much knowledge about Western literature. Thus it was rather tough for me to read through it. After finishing, however, I am quite satisfied with the struggle I had with this book.

The protagonist, named after the author, joins the project being undertaken by the cognitive neurologist Philip Lentz, and trains a series of neural networks, which are named Imp A, B, C, and so on (Imp is an abbreviation for Implementation). Their work place, the Center for the Study of Advanced Sciences, is located at U. Along with

this story, Richard's love affair with his former student C. is told. They once lived together in B. They are however separated, and Richard is attracted to another young lady, A. —Imp A, B, C, etc. are okay, but as for ladies C. and A. and places U. and B., these seem quite rough naming. This might however be a technique to give the story much reality like a private note.—

I have been training a female friend of mine to read and write in English only by exchanging e-mail messages written in English these several months. This limited method of training is in a sense quite similar to Richard's training of neural networks, and I have found many parallels between this novel and my experience. Even from this fact only, I can conclude that this book is well written. Imp H or Helen learned too much and finally ... Oh, this is not what I want to happen between my pupil and me. I highly recommend this novel to all intelligent readers.

April 28, 2002

Biography

Mystery-Like Ending

⋆⋆⋆⋆⋆ **Galileo's Daughter: A Historical Memoir of Science, Faith, and Love.**
By Dava Sobel. *Walker, New York, 1999.*

In the first one-third of the volume the author writes about Galileo's invention of a telescope, first observation of the moon's mountains and valleys, discovery of four satellites of the planet Jupiter, observation of a "nova" to impugn the Aristotelian immutability of the heavens, guess about the nature of sunspots, endeavor to support the sun-centered theory of Copernicus, etc. Thus I thought that the title of the book was inappropriate.

Even reading later chapters, where many letters written to Galileo by his daughter with the name of Suor Maria Celeste are quoted, I thought that this book was a biography of Galileo himself, which well depicted not only his scientific but also his personal life together with family and

social backgrounds. Near the end of the volume, however, there was an episode like a mystery. I felt like thunderstruck, and smiled and said to myself, "Yes, the title is quite appropriate!"

I could not help but imagine what wonderful work would Suor Maria Celeste have done if she had lived in the modern age not as a nun but as a scientist. The book also invoked in my mind great desires to read Galileo's books, *Dialogue on the Two Chief World Systems* and *Two New Sciences*, and to observe planets with a telescope. These facts would prove the excellence of this book.

January 31, 2001

Young Einstein's Life and Work

⋆⋆⋆⋆· **Einstein in Love: A Scientific Romance.**
By Dennis Overbye. *Viking, New York, 2000.*

After studying a large number of published and unpublished letters for a decade, Dennis Overbye, the author of another well-written book *Lonely Hearts of the Cosmos*, successfully portrayed young Albert Einstein from the two sides of his personal life and scientific endeavor. In *Einstein in Love* Albert is depicted vividly as a lad who loved his former physics classmate Mileva and constantly tackled the most profound problems of physics. The author also writes

in detail about the social and scientific backgrounds of the time, as well as places, in which Albert lived. Albert's marriage with Mileva comes to an unhappy ending. Then he marries his cousin Elsa. Albert's dark side during the years of these events does not elude Overbye's polished writing. In the section about Albert's relation to the physicist Hendrik Lorentz, the author writes, "Albert was the eternal outsider"; and at another place, "When it came to women he could be like a child." These words cogently summarize the human side of the scientific giant.

A reviewer who is an expert in physics (A. J. Kox for *Physics Today*) has criticized that Overbye's discussion of science is not always accurate. The present reviewer thinks that if the description of physics were made more compact, this book would have been much more absorbing. Inclusion of a chronological table might have been a good idea. It is a little disappointing that the source of quotation is often of secondary nature; for example, "Bartlett's Familiar Quotations" is cited many times. However, these are only minor defects. This is a laboriously and skillfully written book to be read by all those who love passion and science, and revere "*Time* magazine's Man of the Century."

June 21, 2001

The Nobel Laureate's Success and Frailty

⋆⋆⋆⋆⋆ Strange Beauty: Murray Gell-Mann and the Revolution in Twentieth-Century Physics.
By George Johnson. *Alfred A. Knopf, New York, 1999.*

The author beautifully describes the life and work of the Nobel-winning physicist Murray Gell-Mann and the revolutionary history of elementary particle physics. In addition to how the important discoveries of the Eightfold Way and quarks were made, we learn Gell-Mann's diverse interests in linguistics, ornithology, archaeology, environmental problems and complex phenomena.

The author writes not only about the physicist's brilliance and success but also his human frailties such as his experiences of writer's block and procrastination and his brooding temper, thus making the biography complete as viewed from every side. Not only physicists but also laypersons can enjoy this book.

September 15, 2000

Across Two Disciplines

⋆ ⋆ ⋆ ⋆ ⋆ **Einstein, Picasso: Space, Time, and the Beauty That Causes Havoc.**
By Arthur I. Miller. *Basic Books, New York, 2001.*

What factors can be motivations of a genius's reformative work? Is it possible that the same notions affect geniuses in science and art? What is the daily life of geniuses? What processes are going on when a genius does a monumental work? We often have such questions as above. Arthur I. Miller, Professor of History and Philosophy of Science at University College London, wrote a wonderful book to answer all of those questions and to tell us more about creative activity by the examples of the two giants of the twentieth century, Albert Einstein and Pablo Picasso.

This dual biography centers on the special relativity theory discovered by Einstein in 1905 and the Cubism painting "Les Demoiselles d'Avignon" produced by Picasso in 1907. In the first chapter, the author mentions that Poincare's book "La Science et l'Hypothese" gave a spur to both of the two geniuses and led them to explore new notions of space and time. Tracing their respective lives in later chapters, the author clarifies how both men sought representations of nature that transcend those of classical thought and reach

beyond appearances. The reader would be convinced of the fact that the effect of Poincare's book is not a superficial similarity between the works of Einstein and Picasso but a common denominator deeply rooted in the culture and science of the early twentieth century.

In the last chapter the author insists that at the creative moment boundaries between disciplines dissolve. Namely, aesthetics becomes paramount also in science; on the other hand, artists solve problems just like scientists. So, scientists will find direct interest in the chapters on Einstein and also find it profitable to read the chapters on Picasso; and the reverse will be true for artists. Laypersons will also get a lot of stimuli to a productive life from this book.

July 18, 2002

Includes Gems of Feynman's Words

⋆ ⋆ ⋆ ⋆ ⋆ **Feynman's Rainbow: A Search for Beauty in Physics and in Life.**
By Leonard Mlodinow. *Warner Books, New York, 2003.*

In the winter of 1981, Mlodinow became a post-doctoral fellow at Caltech, where two Nobel Prize winners, Richard Feynman and Murray Gell-Mann, had offices down the hall. The author wanted someone to help him emerge from his

creative drought, and figured that it would be his idol Feynman. One day he knocked on the door to Feynman's office, and was welcome ... This is the story of the author's young days as well as Feynman, Gell-Mann and the world of the physical theory named string theory in its beginning.

In an early chapter we learn that Feynman used to say that there were two kinds of physicists, the Babylonians and the Greeks. The former focused on the phenomena, and the latter, on the underlying order. Gell-Mann was a Greek, and Feynman considered himself a Babylonian. Echoing this, the author understandably writes in a later chapter, "Feynman scorned string theory, Murray championed it. That was Feynman and Murray — attracted by each other's genius, repelled by each other's philosophy."

I have found the following gems of Feynman's words told to the author: "An important part of the creative process is play." "The scientist's imagination always is different from a writer's in that it is checked." "She (Arlene, Feynman's wife in his first marriage) taught me that one has to be irrational sometimes." You might find some more you like in this book.

In the last chapter the author thinks of Feynman in this way, "If there is one thing he taught me, it is the importance of being truly committed to whatever it is we are striving for." This small and readable book would be a good addition to the bookshelf of the fans of the "People's Physicist" Feynman. It is to be noted that the European edition of this book is entitled *Some Time with Feynman*.

Jun 14, 2004

Essays

Brilliant Prediction of the 21st Century

⋆ ⋆ ⋆ ⋆ ⋆ **The Sun, the Genome, and the Internet: Tools of Scientific Revolutions.**
By Freeman J. Dyson. *New York Public Library, New York, 1999.*

In this book Freeman Dyson contends that the driving force of scientific revolutions is more often new tools rather than new concepts. The experimental physicist Peter Galison wrote a tool-biased view of the history of physics, while the theoretical physicist Thomas Kuhn made a concept-biased analysis in his famous book. Being a theorist, though, Dyson considers that Galison's view of science more pleasing, and predicts that three new technologies — solar energy, genetic engineering and the Internet — will be the most important things in the twenty-first century.

Dyson's books have always fascinated me by his wide-ranging intelligence, great insight, keen analysis and con-

vincing arguments based on concrete examples. *The Sun, the Genome, the Internet* is not an exception. An additional agreeable character of his writing consists in the fact that he attaches importance to social justice realizable by technology. He expects that the gap between the rich and the poor would be narrowed by the ethical application of science.

In the final chapters of the book, Dyson discusses the future of the society under the inexorable growth of techniques suggested by the two big surprises that happened in 1997. These surprises are the cloning of Dolly and the defeat of the world chess champion by the IBM chess-playing program Deep Blue. The first of the surprises makes Dyson think about "reprogenetics." It is a possible future technology offering the parent the opportunity to improve the quality of life of the child by removing bad genes and by inserting advantageous ones. We cannot read Dyson's discussion about this possibility without reminding ourselves of the science fiction *Brave New World* by Aldous Huxley.

October 22, 2000

Marked by Original Ideas

$\star\star\star\star\cdot$ **Between Inner Space and Outer Space: Essays on Science, Art, and Philosophy.**
By John D. Barrow. *Oxford University Press, Oxford, 1999.*

This book is a collection of John Barrow's 42 essays mostly published between 1980 and 1998, but none of the topics treated has become out-of-date. Each piece of essay makes a chapter, and all the chapters are grouped into 10 parts. A short introduction in each part clearly sets the theme common to all the chapters of that part as well as the specific subjects of the chapters. The title of every chapter is quite attractive to those interested in the fundamental problems of physics and cosmology and in their relations to, or a physicist's view of, other disciplines of mathematics, aesthetics and religion. Barrow's writings are sometimes not easy to follow, but are marked by originality of ideas.

For example: In the chapter "Why is the Universe mathematical?" the author first mentions that the sorts of answers depend upon what we think mathematics. Then he puts a puzzle, which is more fundamental in the laws of Nature, symmetry or computation. In the final paragraphs, Barrow states that the science is the search for algorith-

mic compressions of the world of experience, and comes to the conclusion that mathematics is useful in the description of the physical world because the world is algorithmically compressible. I have difficulty in finding how the earlier paragraphs are related to the last ones. However, the conclusion seems to be simple and persuasive, and would be paraphrased as follows: Mathematics is useful in the description of Nature because she has the characters of orderly complexity.

Only if you haven't read other books by Barrow and want to know his ideas, this would be a good buy.

October 27, 2000

Leads Us to Deep Thinking

$\star\star\star\star\cdot$ **Facing Up: Science and Its Cultural Adversaries.**
By Steven Weinberg. *Harvard University Press, Cambridge, Mass., 2001.*

The author Steven Weinberg is the Nobel-winning theoretical physicist. In this book, 23 essays written between 1985 and 2000 are collected. The dust cover of the book has a photo of the statue of the 16th century astronomer Tycho Brahe with a posture of facing up. The author writes in the preface that this is only part of the reason for his choice

of "Facing Up" for the title of the book. The other part of the reason is described as follows: Each of the essays in this collection struggles with the necessity of facing up to the scientific discoveries that show the laws of nature are impersonal, with no hint of a divine plan or any special status for human being. Weinberg adds some words about his viewpoints: rationalist, reductionist, and so on. These aptly describe his personal philosophy underlying all the essays in this volume.

In a sense the reductionism or the physics imperialism is considered a defective thought these days. However, Weinberg's reductionism (called "objective reductionism" in chapter 2 and "grand reductionism" in chapter 10) means the notion: "There are arrows of scientific explanation that converge to a common source at the level of the very small." He does not necessarily mean the constituents of the upper level structure by "the very small." Nor does he deny the emergence of new concepts at higher levels of organization to understand the behavior at those levels. Thus I find myself comfortably agreeing with him about defending his reductionism. As for his criticism of social constructivism (chapter 9), I also hold an opinion similar to his.

On the other hand, Weinberg's attack on religions is so scathing (especially in chapters 20 and 22) that I cannot completely agree with him, though I do not believe in any religion. He looks only at the aspect of religions as the adversary of science on the basis of big historical events unhappy to religions. In spite of this disagreement, I find instructive expressions here and there in this book. For example, I like Weinberg's words, "We will need to confirm

and strengthen the vision of a rationally understandable world if we are to protect ourselves from the irrational tendencies that still beset humanity (chapter 12)." To sum up, this book gives the reader good learning and a chance of deep thinking about the significance of science, religion and philosophy.

October 5, 2002

Religion and Philosophy

Self-Evident Principle Well Treated

⋆⋆⋆⋆· **Rocks of Ages: Science and Religion in the Fullness of Life.**
By Stephen J. Gould. *Ballantine Books, 1999.*

Steven Gould treats the long-standing problem of the relation between science and religion in this book. The author explores the contemporary principle he calls NOMA, which is an acronym of Non-Overlapping Magisteria. A magisterium represents a domain of authority in teaching. The NOMA principle is that the magisterium of science and that of religion do not overlap, because the two magisteria cover different realms of empirical facts and moral value.

This might seem to some readers almost self-evident. Describing the historical and psychological bases extensively, however, Gould elaborates the above concept deeply and persuasively, so that even such readers will find the reading of this book rewarding. Especially this is a must

read for those who are on either side of the debate of evolution versus creation in education.

October 14, 2000

Scholarly Writing on Einstein's Philosophy

⋆⋆⋆⋆· **Einstein and Religion: Physics and Theology.**
By Max Jammer. *Princeton University Press, 1999.*

In the first chapter that deals with Einstein's personal attitude toward religion, we learn the followings: Einstein regarded science and religion as mutually depending on each other, which is evidenced by his words, "Science without religion is lame, religion without science is blind." However, the predominant motivations that led him to his development of the theory of relativity were purely physical considerations. Like Spinoza, Einstein denied the existence of a personal God, and used the term "cosmic religious feeling" to describe the sublimity and marvelous order in nature.

Near the end of the first chapter, the author asks a question, "Did Einstein's conception of religion affect his scientific work?" and derives a positive answer. The story that Einstein's introduction of the cosmological constant was religiously motivated concludes the chapter.

The second chapter discusses what Einstein has written about the nature of religion and its role in human soci-

ety. Einstein's "Credo" about the cosmic religious feeling is cited repeatedly. In his essay that was read at a conference held in 1940, Einstein called the doctrine of a personal God not only unworthy but also fatal. The author writes about many responses Einstein got in reaction to this essay. At the end of this chapter the author analyzes Spinoza's role in the development of Einstein's religious philosophy.

As can be seen from the above, topics given in the first two chapters are quite attractive, and explanations are instructive to the reader who has interest in the mental background of Einstein's academic work. The scholarly style of the author's writing is enjoyable.

However, the third and final chapter that describes the influence of Einstein's scientific work on theology was not interesting to me at all. After finishing the book, I read Introduction section of the book again. To my great relief, I found the following words of the author near its end: "It is possible that [Einstein] would have rejected all of the arguments in chapter 3 if he were alive." The reason why I was not interested in the final chapter was that my thought about religion was the same as Einstein's!

Thus I recommend the first two chapters to all those who have interest in Einstein or religion, but do not recommend the third chapter to those who think like Einstein.

December 6, 2001

Cosmology

Rather Bright on Dark Matter

⋆ ⋆ ⋆ ⋆ · **Quintessence: The Mystery of the Missing Mass in the Universe.**
By Lawrence Krauss. *Basic, New York, 2000.*

Will the universe expand forever, begin to contract at some time in the future, or get to a balanced state? The answer depends on the amount of mass it contains. To explain the behavior of galaxies unaccountable by the mass of visible matter, the idea of "dark matter" was proposed in the 1980s.

In the title of the book "Quintessence" means "The Fifth Essence." The latter was the title of the first edition of this book published in 1989. In ancient philosophy, it meant the heavenly material that was supposed not only to form stars but also to pervade all things, and is used here to represent dark matter.

Lawrence Krauss starts the story by an intriguing brief

review of the earliest notions of cosmologies and gives an updated and much detailed account of the dark matter problem for lay readers. The account covers both theoretical and experimental studies including those to be done in the near future. Some chapters might be hard for bedside reading even for scientists, because the author often lays one reason upon the other for an explanation. However, the thorough reading of this book would be rewarding if you like to wonder about the mysteries of the universe and scientists' efforts to resolve them.

The book contains some irritating errors. For example, "decrease" should read "increase" at one place, and "charge" should read "change" at another.

October 8, 2000

The Man, His Equation and Cosmology

⋆ ⋆ ⋆ ⋆ ⋆ **God's Equation: Einstein, Relativity, and the Expanding Universe.**
By Amir Aczel. *Four Walls Eight Windows, New York, 1999.*

Amir Aczel describes Einstein's equation of general relativity that governs the behavior of the universe from its birth to a possible role in the near future. The story is beautifully woven together with the latest finding in cosmology

and the riddle of creation. While a few lines of equations are shown, their meaning is explained by simple terms that can be understood by lay readers.

On the basis of Einstein's letters that became accessible recently, Aczel tells for the first time the great physicist's efforts to get a prediction of his theory experimentally proved. Thus the author well succeeds in revealing a human side of the person who discovered God's Equation. This is a readable and absorbing book.

October 15, 2000

Would the Final Theory Be Beautiful?

⋆⋆⋆⋆⋆ **Accelerating Universe: Infinite Expansion, the Cosmological Constant, and the Beauty of the Cosmos.** By Mario Livio. *John Wiley & Sons, New York, 2000.*

A cosmologist and art fanatic, Mario Livio, elegantly tells the general reader about the recent observational finding that the expansion of the universe is speeding up contrary to the long-held belief of slowing-down expansion. He stresses the effect of this finding on the beauty of the fundamental theory of the universe; or rather the central theme of the book is that beauty.

Livio clearly explains his requirements for the beauty in physical and cosmological theories: symmetry, simplicity, and the Copernican principle (the principle means that we are nothing special). According to the author, the tentative discovery of the accelerating expansion of the universe poses a frightening challenge to the beauty of the final theory by raising difficult questions about the non-zero value of the cosmological constant (or the energy of the vacuum). From the viewpoint of the Copernican principle, Livio rejects resorting to the anthropic principle for giving a quick answer to those questions. The story told about the recent finding of extrasolar planets is intriguing and helps strengthen the basis of the expanding Copernican principle.

The book is so good that I am tempted to write all of its minor deficiencies I have noticed: The explanation of the inflationary model is not very understandable as the author himself admits in the book. The author's bottom line for Carter's argument about the rarity of extraterrestrial intelligent civilization is rather confusing, because the latter's argument seems simply wrong due to the contradiction of his conclusion to his two-possibility reasoning, aside from the dubiousness of his crucial assumption at the start. In the last chapter Livio writes about Wheeler's view of the participatory universe, but its distinction from the anthropic principle, if any, is not made clear. The first name of the Japanese physicist and cosmologist Katsuhiko Sato is wrongly written as Katsuoko. It would have been much better to include the bibliography of the books cited and that of photographs of many paintings referred to.

October 31, 2000

Prospects of Observations

⋆⋆⋆⋆· **The Runaway Universe: The Race to Find the Future of the Cosmos.**
By Donald Goldsmith. *Perseus, Cambridge, Mass., 2000.*

From observation of supernovae, i.e., large exploding stars, two rival teams of astronomers recently found that the expansion of the universe was very possibly accelerating. The astronomer and science writer Donald Goldsmith tells laypersons the story centered on this discovery in this book. To explain the accelerating expansion, astronomers have revived Albert Einstein's "cosmological constant," which he called his greatest blunder. It is interesting that the same author published a book entitled *Einstein's Greatest Blunder?* just a little before the announcement of the above discovery.

Before going into the main topic of the finding of the accelerating expansion, Goldsmith gives introductory chapters on the discovery of galaxies, the expansion of the universe, the inflationary theory of the cosmos, and the existence of dark matter in the universe. These chapters might be somewhat tedious for those who already learned about them. When the story comes to the central theme, however, almost all readers would be fascinated by the author's clear

explanation of painstaking research into cosmic riddles.

Without using equations but effectively using some photographs and diagrams, Goldsmith succeeds in telling what has happened and is going to happen at the forefront of cosmology. The last chapter deals with pleasant prospects of astronomical observations in the nearest future, which will use new satellites and other powerful instruments to resolve many of the mysterious issues of cosmology including the fate of the universe.

December 29, 2000

Astounding Discovery

⋆⋆⋆⋆⋆ **The Extravagant Universe: Exploding Stars, Dark Energy, and the Accelerating Cosmos.**
By Robert P. Kirshner. *Princeton University Press, Princeton, 2002.*

Most cosmologists long believed that the universe would expand at a decelerating rate. Contrary to this belief, two teams of astronomers independently announced in 1998 the observational results that indicated the accelerating expansion of the universe since about 5 billion years ago. One of the two teams was called the Supernova Cosmology Project and led by Saul Perlmutter of Lawrence Berkeley National

Laboratory in California, and the other was the High-z Supernova Team led by Brian Schmidt of Mount Stromlo and Siding Springs Observatories in Australia and the author of this book, Robert Kirshner of Harvard-Smithsonian Center for Astrophysics.

Before reading this book I already learned much about this astounding finding from the following books: Amir D. Aczel, *God's Equation* (1999); Donald Goldsmith, *The Runaway Universe* (2000); and Mario Livio, *The Accelerating Universe* (2000). The person who read one or more of these books like me might think the earlier chapters of *The Extravagant Universe* not so attractively written. As distinct from the other authors, however, Kirshner includes some passages useful to students and young scientists. For example, he writes in chapter 4, "You don't always have to understand the details of the mathematics to contribute to the advance of science"; and in chapter 6 he heuristically discusses various possible sources of observational errors.

From chapter 9 on, the narrative becomes quite absorbing. We get such high excitement of the intellectual work leading to the discovery that can be conveyed only by the person who actually engaged in it. It is wonderful that mankind can learn something about the fate of the universe, though we do not yet know what dark energy, i.e., the source of acceleration, really is.

I like the last pages of this book, on which the author describes why cosmology is important to us. Decision makers of science policy should read these pages at least. All the readers who are interested in the wonders of nature and the universe will surely be interested in this book. Vividly

describing scientists' life filled with collaboration, competition, annoyance, confidence, etc., this is a good book especially for young people.

September 18, 2003

Deep Mysteries of the Cosmos

⋆⋆⋆⋆⋆ **Our Cosmic Habitat.**
By Martin Rees. *Phoenix, London, 2003.*

Martin Rees, Astronomer Royal of Great Britain, wonderfully tells everything about cosmology in this concise book. The reader is lead to a quick tour from Big Bang to biospheres, from the beginning to the end of the universe, and from the micro-world to the cosmos. Yet the description is not superficial but very deep.

Among many of mysteries we learn from this book, I mention here only a few big ones. (1) Dark matter: This prevails over visible matter in constituting the total energy of the universe. It is the No. 1 problem in astronomy today, and ranks high as a physics problem, too. (2) Vacuum energy: This is the origin of the accelerating expansion of the universe. Its nature is a challenge to theorists; it holds important clues to the early universe and the nature of space. (3) Other universes: Our universe may be just one of them. While seeming to be in the province of metaphysics

rather than physics, these already lie within the proper purview of science.

The author says that the phrases often used in popular books, "final theory" and "theory of everything," are misleading and that some of nature's complexity may never be explained and understood. These words just made the scales fall from my eyes. I strongly recommend this book to laypersons interested in astronomy, cosmology, problems at the boundary between science and philosophy, and the deep mysteries of nature.

December 23, 2003

Life Science

Brilliant Words of Great Minds

⋆ ⋆ ⋆ ⋆ · **A Glorious Accident: Understanding Our Place in the Cosmic Puzzle.**
Edited by Wim Kayzer. *W. H. Freeman, New York, 1997.*

Wim Kayzer interviewed six great thinkers: the psychiatrist and neurologist Oliver Sacks, the philosopher Daniel C. Dennett, the paleontologist and evolutionary theorist Stephen Jay Gould, the physicist Freeman Dyson, the biochemist Rupert Sheldrake, and the historian and philosopher of science Stephen Toumlin. Then all of them participated in a round table to discuss the deep and 'unanswerable' questions mainly related to our consciousness. The content of this book was originally broadcast as a television series.

In general, one expects to get more systematic information from a book on science or philosophy of science than from a television program on the same topic, but naturally

we cannot have this expectation for a book produced from a television program. Further, when an interview or round-table program is put into printed lines, the discursiveness of spoken words comes to the surface, and the program is apt to lose some of exciting flavors present in broadcasting. This book is not an exception of this phenomenon, and thus is good only for casual entertainment but not good for obtaining substantial knowledge. Reading carefully, nevertheless, one can find some brilliant words of the great minds here and there.

November 1, 2000

Mathematics

Good for Amusement

⋆⋆⋆⋆· **The Joy of Pi.**
By David Blatner. *Penguin, Toronto, 1997.*

This little book tells us in a cheerful manner about the history and snippets of the number π, the ratio of a circle's circumference to its diameter. Many facts and factoids about π are collected here. There are some equations, but those who don't like equations can appreciate them like beautiful illustrations.

In the section "Memorizing Pi" the author gives mnemonic devices in different languages. The description of one in Japanese includes errors. In fact, there is a better one in Japanese, which goes: "San-i-shi (314) i-ko-ku (159) ni (2) mu-ko (65). San-go (35) ya-ku (89) na-ku (79) ..." down to the 1000th digit in a version. These Japanese words mean: "An obstetrician goes to a foreign country. After childbirth, without misfortune ..."

The present reviewer told the author about the errors and the better mnemonic, so that he will possibly take them into account in the revised edition. Aside from the above minor defects, however, the present edition is quite a good read for amusement.

October 14, 2000

Guided Tour to Higher Dimensions

⋆⋆⋆⋆· **Flatterland: Like Flatland, Only More So.**
By Ian Stewart. *Perseus, Cambridge, Mass., 2001.*

The heroine Vikki Line is a great-great-granddaughter of the narrator A. Square of Edwin Abbott's classic book, *Flatland*. The teenaged Flatlander heroine goes to a tour to higher dimensional worlds guided by a Space Hopper. She visits the Fractal Forest, Topologica, Platterland, Cat Country, the Domain of Hawk King, etc., and learns, together with the reader, about many concepts of modern mathematics and physics. The author Ian Stewart, a winner of the Royal Society's Michael Faraday Medal for furthering the public understanding of science, writes the story in the style of Lewis Carroll's *Alice in Wonderland* using enjoyable wordplay and putting exotic and cute creatures he invented to familiarize the difficult concepts.

Some topics are treated in a manner to give the reader good understanding, but others are described only superficially. There are simple errors in giving a number for fractal dimension and describing the behavior of the decoherence time. (I leave it to the reader as exercises to spot them.) The author explains the particle nature of the photon by the uncommon use of the process of electron-impact photon emission, while the orthodox explanation uses the inverse process, i.e., the photoelectric effect.

In spite of these minor defects, this is a joyous read for holidays. The heroine is depicted as such a clever, adventurous and charming linear being (near the end of the story she comes to know that she is something superior than a line) that I think how I would have been happy if I had had a girlfriend like her in my youth. Her guide and tutor, the Space Hopper, often shows a big grin, reminding us of the popular physicist and good lecturer Richard Feynman. In the short last chapter, the reader feels it important that more of us, "Planiturthians," become aware of the possible ten-dimensional reality of our physical universe, which Vikki learned at the final stage of her tour. Thus, I would like to recommend this book to every curious mind.

June 17, 2001

Infinity and Cantor's Life

⋆⋆⋆⋆· **The Mystery of the Aleph: Mathematics, the Kabbalah, and the Search for Infinity.**
By Amir D. Aczel. *Simon & Shuster, New York, 2000.*

Is infinity a number? Who invented or discovered infinity? Is one kind of infinity larger than the other? Is there anything yet unknown about infinity? If you have such questions, this is a good book for you.

Amir D. Aczel is a mathematician, and wrote the much-acclaimed book *God's Equation: Einstein, Relativity and the Expanding Universe*. He produced here another interesting book by telling stories about the study of infinity. In the introductory chapter numbered aleph-0, the author writes briefly about the life of the mathematician Georg Cantor and his "continuum hypothesis" together with its equation using the Hebrew letter aleph. The symbol aleph with a subscript 0, 1, 2, etc., invented by Cantor, denotes the order or the different level of infinity.

In the following chapters Aczel describes the history of searching infinity. The story starts from its discovery by Greeks in the fifth or sixth century B.C. and includes the concept of infinity in the Kabbalah (a system of Jewish mystical philosophy), discoveries about the nature of infin-

ity by Galileo and Bolzano, and studies by mathematicians in Berlin during the period from 1860 to the start of World War I. Next, the author explains about irrational numbers. Reading about these, the reader might almost forget about Cantor told at the beginning of the book.

After reading about 40% of the text, however, the reader is brought back to the central story about Cantor. Cantor got strong opposition against his research from his former teacher Leopold Kronecker. This fact and the difficulty of proving his continuum hypothesis seem to have been responsible for Cantor's mental problems. The story of Kurt Gödel, who further developed the work of Cantor, comes next, and the reader learns that Gödel also got mental illness. The author writes in one of the endnotes that Cantor and Gödel were not the only mathematicians working in the field of the foundations of mathematics to suffer from mental illness and that it is interesting to contemplate the reasons for this. Some readers might wish to read Aczel's another book on this contemplation in the near future.

In the final chapter we find the question, "Do numbers actually exist?" The author writes the answer he believes to be the case, and gives a beautiful ending by quoting the sentence from a commemorative plaque of Cantor in Halle. The sentence, Aczel thinks, captures Cantor's deepest conviction about mathematics. Even the reader without much knowledge of mathematics can enjoy this book, if she or he is a little patient to read technical passages. In those passages the author understandably explains the proofs of some natures of infinity discovered by Cantor.

August 24, 2002

Mysteries of the Ubiquitous Number Phi

⋆ ⋆ ⋆ ⋆ ⋆ **The Golden Ratio: The Story of Phi, the World's Most Astonishing Number.**
By Mario Livio. *Broadway, New York, 2002.*

Mario Livio, a cosmologist and art aficionado at the Hubble Space Telescope Center and the author of the previous book *The Accelerating Universe*, wrote a lot about the irrational (never-ending, never-repeating) number phi, or the Golden Ratio, whose value is 1.6180339877... The story starts from these questions: Who discovered the Golden Ratio? Was phi used in the design of a Babylonian stela and Egyptian pyramids? The author pursues the answers to these questions, writing a series of his thoughts like a detective story.

Then he describes the role of the Greek mathematicians Plato and Euclid, and the Italian mathematician Leonardo Fibonacci in the history of phi, together with the geometrical and arithmetical wonders connected to this number. One example of the wonders is the relation between the Fibonacci sequence and phi. The Fibonacci sequence 1, 1, 2, 3, 5, 8, ... is defined as a series of numbers in which each term is the sum of the two preceding terms. The ratio of successive numbers of this sequence approaches phi as we

go farther and farther down the sequence.

Next come the topics of phi found in nature and used in arts. The logarithmic spiral, which goes hand in hand with the Golden Radio, appears in the sunflower, the flight of a falcon, galaxies, etc. The author's study of many historical attempts to disclose the Golden Ratio in various works of art, pieces of music and poetry comes to the conclusion that ... (I have to refrain from writing the ending of the "detective story").

In the final chapter Livio considers the question: What is the reason that mathematics and numerical constants like phi play such a central role in topics ranging from fundamental theories of the universe to the stock market? Noting that the discussion about this question can fill the entire volume, the author gives a brief (but very understandable) description of the modified Platonic view and the natural selection interpretation. He also presents his personal opinion, which adopts the complementarity of the above two views. This chapter whets readers' appetite for a possible next book on this topic to be written by Livio.

I strongly recommend this book to the scientists, artists and laypersons who are interested in the wonders of numbers and mathematics and in their relations to arts and nature.

March 31, 2003

Physics

Gives the Flavor of Difficult Problem

⋆⋆⋆⋆· **Three Roads to Quantum Gravity.**
By Lee Smolin. *Basic Books, New York, 2001.*

The completion of a quantum theory of gravity (quantum gravity for short) is one of the most challenging problems in science in the twenty-first century. This theory aims at unifying Einstein's theory of general relativity for large-scale phenomena with the quantum theory for the micro-world, to get understanding of everything from space and time to matter and the universe. Lee Smolin, Professor of Physics at Pennsylvania State University, tells the story of recent and future research pursuing this theory for the intelligent layperson.

The author writes earlier chapters very understandably. The reader who knew nothing about the quantum gravity learns easily the following interesting things: There are three approaches to quantum gravity, i.e., the route from

quantum theory (string theory), the road from the theory of general relativity (loop quantum gravity), and the path from fundamental principles. To do cosmology, the classical logic demanding that every statement be either true or false is inadequate. A theory of quantum gravity has to answer about the nature of the information tapped in a quantum black hole. The search for the meaning of the temperature and entropy of a black hole is now leading to the discovery of the atomic structure of space and time. And so on.

In one of the middle chapters, the author states that the style of these chapters will be more narrative than others because he can describe from personal experience some of the episodes in the development of loop quantum gravity. Lessons told are, for example, as follows: Science progresses quickly when people with different backgrounds and educations join forces. Einstein's example teach us that trying to invent new laws of physics requires not only intelligence and hard work but also insight, stubbornness, patience and character. Of course, these are also quite understandable.

In the last three chapters some or most of readers might find it difficult to follow the author's explanation. After reading the whole book, however, all the readers would feel that they have gotten at least a vague picture about the difficult problem of proceeding to quantum gravity. This is an exciting book for those who want to catch a glimpse of theoretical physics at its forefront.

There are some typos. Among them the followings are especially unfortunate, because the meanings of one of the laws of thermodynamics and the Heisenberg's uncertainty

principle are completely reversed to lead laypersons astray: In chapter 7, "The second law of thermodynamics requires only that the total entropy of the world never increase" should read "...never decreases." In two inequalities in chapter 11, the symbol $<$ should read $\geq$.

July 27, 2001

Reason for Existence

$\star\star\star\star\cdot$ **Lucifer's Legacy: The Meaning of Asymmetry.** By Frank Close. *Oxford University Press, Oxford, 2000.*

The author beautifully narrates to laypersons how broken symmetry, i.e., asymmetry born from symmetry, is important in the natural world for the existence of life, molecules, atoms and elementary particles. The riddle of the symmetry associated with the last of these items when the universe was created is yet to be solved in the near future. At the end of the book, the reader will be surprised to learn that Pasteur anticipated the importance of asymmetry in 1860.

In an early chapter the author writes about the moderately well known teaser "Why do mirrors reverse left and right but not top and bottom?" His answer to this mirror puzzle is astonishingly simple. However, he should have been careful to give a more educational answer that includes the explanation for the reversal of the left- and right-

handedness in mirrors, because he describes about "mirror asymmetric" left-handed and right-handed molecules, right-handedness of DNA and left-handedness of "the mirror DNA," etc. in a later chapter. [The latest academic articles on the mirror reversal problem can be found in M. C. Corballis, *Psychonomic Bulletin & Review* Vol. 7, No. 1, pp. 163–169 (2000) and T. Tabata and S. Okuda, ibid. pp. 170–173 (2000).]

This book would also be interesting for scientists to learn how they can talk well about scientific topics to laypersons. It would have been much better for the book to include a bibliography for quotations and further reading.

August 27, 2000

Physics Adventure Modernized

⋆⋆⋆⋆· **The New World of Mr Tompkins.**
By George Gamow and Russell Stannard. *Cambridge University Press, Cambridge, 1999.*

The famous physicist and excellent popularizer of science George Gamow wrote the original version of this book *Mr Tompkins in Paperback* in 1965. Since then the understanding of the physical world from its smallest to largest entities has shown much progress. Thus the book, which was once one of the best classics among the genre of physics

popularization, needed a revision to continue its role of introducing the modern knowledge of fundamental physics to laypersons.

Russell Stannard, an able popularizer of science, courageously tackled this difficult problem of modernizing *Mr Tompkins*. Four chapters out of 17 are entirely new. Old chapters describe the theory of relativity, quantum physics and atomic and nuclear physics through Mr Tompkins' adventurous dreams and a series of lectures given by "the professor" to the lay-audience. Tompkins is among the listeners of the lectures, and gets acquainted with the professor's daughter Maud. Maud's look, hairstyle and dresses in illustrations and the episode of romance have also been modernized. The new chapters treat black holes, a high-energy accelerator ("atom smasher") and the results of physics gotten by it, quarks and the Standard Model, and the relation between the life of the Universe and particle physics.

Even the old chapters have been rewritten considerably. For example, Chapter 2 newly tells about an experimental evidence by neutral pion decay for the constancy of light speed, demonstration of relativistic time dilation at CERN by the change of life time of muons traveling at high speed, etc. The "twin paradox" of relativity has also been added in Chapter 2, and its further explanation is given in Chapter 3 (here is a minor but confusing error of "she" and "he" wrongly interchanged). I like this addition very much, because the "paradox" bothered me even after I had learned the theory of relativity at university. (For a more complete explanation of the twin paradox, I recommend Max Born's *Einstein's Theory of Relativity* to readers of an inquiring

mind.)

Being one of old Japanese fans of Tompkins, I feel a little sorry that the name of Hideki Yukawa has disappeared from the present version. Surely, his meson theory of nuclear forces became outdated, because constituents of nucleons and mesons, i.e., quarks and gluons, had been discovered. However, Yukawa's theory was a strong driving force for the birth of particle physics, and a good place where his name can be mentioned remains in Chapter 13 (in the original version it appeared in a later chapter, which has been omitted in the present version).

I highly recommend this book especially to young people who wish to major in physical sciences. There are a small number of simple equations of relativity and formulas of particle reactions. For those who are eager to learn about mysteries of the micro world and the universe, however, the presence of these would not be any hindrance to the enjoyment of the book but rather be an attractive feature. Some of old fans of Tompkins would also read the new version to welcome Stannard's good job.

July 11, 2001

Theories of Physics at the Forefront

⋆ ⋆ ⋆ ⋆ ⋆ **Supersymmetry: Unveiling the Ultimate Laws of Nature.**
By Gordon Kane. *Perseus, Cambridge, Mass., 2000.*

For forty thousand years humans have tried to know how the universe works, and now physicists are approaching to the ultimate understanding of the laws that govern the natural world. Gordon Kane, a renowned particle physicist at the University of Michigan in Ann Arbor, describes the theories at the forefront of this majestic human endeavor in a readily understandable manner. The author calls the theories that work at different distance scales "effective theories," and an ultimate theory of nature "the primary theory."

The central theme of this book is the supersymmetry theory. This theory is expected to extend the Standard Model, the validated effective theory on a scale of about a hundred million billionth meter, down to the wondrous scale of nearly a hundred million billion billion billionth meter (Planck scale), but it is not yet the primary theory. Thus the author also explains the possible relations of the supersymmetry and the next possible effective theory called string theory, and their way up to the primary theory.

Kane writes not only about the features of the theories but also how these would be tested experimentally. To confirm that the supersymmetry is really the next stage toward the primary theory, particles called Higgs boson and "superpartners" have to be found in the giant accelerators. Topics of "research in progress" are often referred to in this book, so that the author uses an acronym of RIP for such research. It is wonderful that many problems in RIP are treated in simple words. This is quite an inspiring book, and I strongly recommend it to all the persons with an inquisitive mind.

September 19, 2000

The Title with Triple Meaning

⋆⋆⋆⋆⋆ **Driving Force: The Natural Magic of Magnets.**
By James Livingston. *Harvard University Press, Cambridge, Mass., 1996.*

The author starts this book by the story of Albert Einstein at the age of four or five, when his father showed him a compass needle. The behavior of the needle gave a deep and lasting impression on young Einstein. Then the author describes ten facts about the magnetic force in earlier chapters. Using these facts, he gives detailed explanations on

the workings of various magnetic devices and the modern technologies of magnets in plain words.

The topics covered includes superconducting magnets, magnets in motors, speakers, TVs, toys, fiction, magic and weapons, magnetic recording, magnets in medicine, biomagnetism, and so on, namely everything about magnets. The book is also interspersed with humorous comments.

In the last chapter the author goes back again to young Einstein's wondering at a compass needle. The reader notices here that the title of the book has the triple meaning. This is one of the most educational and well written books I have ever read in the genre of science for laypersons.

August 31, 2000

Providence or Multiverse?

$\star\star\star\star\cdot$ **Just Six Numbers: The Deep Forces That Shape the Universe.**
By Martin Rees. *Basic Books, New York, 2000.*

Martin Rees skillfully describes the mysteries of the physical laws that govern our universe for a general readership. On page 2, he gives a list of explanations for the six numbers he discusses in this book. Readers may feel it necessary to look back this list often while reading later chapters. For

this purpose, the explanations are a little lengthy and lack the rigor of definition. However, this is a minor defect.

The author ingeniously makes the readers wonder about the deep forces that shape everything from galaxies to life on earth to lead them to the final chapter. There they would be interested in guessing by themselves if the fine-tuning of the values of the six numbers is the result of providence or multiverse.

August 31, 2000

Joseph Weber, LIGO and Much More

⋆⋆⋆⋆⋆ **Einstein's Unfinished Symphony: Listening to the Sounds of Space-Time.**
By Marcia Bartusiak. *Joseph Henry, Washington, D. C., 2000.*

In this book Marcia Bartusiak, an excellent science journalist, writes about scientists' endeavors to detect gravitational waves coming from deep space. The existence of gravity waves was predicted by Albert Einstein's theory of general relativity, and they are considered to have the frequency falling into the audio range, but no one has ever listened to them. Thus the author elegantly entitled this book "Einstein's Unfinished Symphony." Each chapter also has the title related to music. For example, the chapter

about the discovery of the Hulse–Taylor binary pulsar, indirect evidence for gravity waves, is cogently entitled "Pas De Deux."

Bartusiak's sentences are also rhythmic like music, especially in the earliest chapters, so that the reader comfortably learns about Einstein's discovery of the origin of gravity and Renaissance in relativity made theoretically by John Archibald Wheeler and experimentally by Robert Dicke. Wheeler is quoted to have explained general relativity in one clear sentence, "Mass tells space-time how to curve, and space-time tells mass how to move."

The pioneer of experimental work directly to catch gravity waves was Joseph Weber. He published his first results in 1969, claiming evidence for observation of gravity waves based on coincident signals from two bar detectors. Unfortunately, by the middle of 1970s nearly everyone came to agree that Weber was mistaken. Bartusiak writes that Weber had however created a momentum that could not be stopped. Weber died on 30 September 2000, just a few months before the publication of this book. Thus the book partially happened to become one of the earliest tributes to Weber. His first bar detector is now shown in the Smithsonian Institution in Washington, D. C.

Then comes the central story of this book, the construction, improvements and prospects of the Laser Interferometer Gravitational-wave Observatory (LIGO). LIGO is a gigantic instrument system placed in Livingston, Louisiana, and Hanford, Washington. Its construction started as a collaborative project, involving dozens of scientists and the cost of more than $370 million. Among those scientists,

Rainer Weiss is considered to be the founding father of the effort. His career began with a determination to get rid of the noises in a hi-fi system, only to transfer that interest ironically or rather wonderfully to reducing the noises that could mask a gravity wave.

Each piece of LIGO's detector includes a marvel of engineering. LIGO's "classy" physics and the virgin territory of possible gravity wave astronomy are gathering young physicists from around the world. Potential sources of gravity waves cataloged so far by Kip Thorne's Caltech team and other theoretical groups around the world are many and varied from black hole collisions to neutron-star mountains. The author tells us all the details of these in a quite understandable manner. She also describes gravitational research in countries other than United States and projects by the use of spacecrafts.

The book is well balanced between theory and experiment, between science and sociology, and between anecdotes and stories of serious pursuit. As for anecdotes, there is one about the fact that the term "black hole" caused a problem for a while in France. Read the book for the reason. This is a masterpiece of nonfiction, and will absorb the mind of both a scientist and a layperson.

August 19, 2001

Four and More Space Dimensions

⋆⋆⋆⋆⋆ Surfing through Hyperspace: Understanding Higher Universes in Six Easy Lessons.
By Clifford A. Pickover. *Oxford University Press, New York, 1999.*

The four-dimensional world treated in this book is not the space-time of the theory of relativity, but the world with a fourth spatial direction different from all the directions of our normal three-dimensional space. A number of books on the fourth dimension had already been published. So, why did Pickover, an IBM researcher who published many popular books, write this book? He gives an answer in the preface: The main purpose of the book is to tell the reader the physical appearance of four-dimensional beings, what they can do in our world, and the religious implications of their penetration into our world, with a few simple formulas and computer programs to aid the understanding of the four- and more-dimensional spaces (those who are not interested in computing can easily skip them).

The author presents an SF story, in which an FBI agent, "you," gives personal lectures on hyperspace to his younger fellow agent Sally. Finally they both experience surfing into a four-dimensional world. Meanwhile the reader learns

concepts and terms such as hyperspheres, tesseracts, enantiomorphic, extrinsic geometry, quaternions, nonorientable surfaces, etc. The author succeeds in achieving his aim rather well by the use of many illustrations and computer graphics, though he cites too much from Edwin Abbott's *Flatland* in early chapters and from Karl Heim's *Christian Faith and Natural Science* in later chapters.

The book has nine Appendixes (one is a list of SF stories and novels about the fourth dimension), "Notes" and "Further Readings" sections, and Addendum about recent publications dealing with parallel universes and cosmic topology. These are also interesting and informative. This is a good book especially for theologians, philosophers, artists, and general readers who like wild imaginations or computer experiments. To the serious reader who wants to know the implications of hyperspace in modern physics, I would like to recommend Michio Kaku's *Hyperspace*.

September 11, 2001

Approaches to the Unified Theory

⋆⋆⋆⋆⋆ **The Universe in a Nutshell.**
By Stephen Hawking. *Bantam, New York, 2001.*

Stephen Hawking occupies the Lucasian chair at the University of Cambridge, which was once held by Isaac New-

ton before its motorization as Hawking writes humorously. Hawking is also regarded as one of the most brilliant theoretical physicists since Albert Einstein. His previous book, *A Brief History of Time*, was sold an estimated 25 million copies world over, but was notorious for mostly not being read beyond the earliest chapters. *The Universe in a Nutshell* is a sequel to it, including many illustrations and telling in a more readable style about the major breakthroughs that have occurred in the field of theoretical physics after the release of the first book.

The author writes in the foreword that the structure of the book is like a tree, the first two chapters forming a central trunk from which the other chapters branch off. Thus, after reading two introductory chapters on the theory of relativity and "the shape of time," the reader can jump to any of later five chapters on the development of the universe, black holes, the possibility or impossibility of time travel, our future, and the future journey of discovery.

Many scientists have tried to avoid addressing a question about the beginning of the universe. In chapter 3, however, Hawking states the necessity of trying to understand it on the basis of science for the following reason: If the laws of science are suspended at the beginning of the universe, they might fail also at other times.

The universe is considered to have begun in a Big Bang, a point where the whole universe was scrunched up into a single point of infinite density. At this point Einstein's general theory of relativity cannot be used, because when the universe is small the uncertainty principle of quantum mechanics is important. Therefore, we need a "quantum

theory of gravity," a unified theory of the general theory of relativity and the quantum mechanics, and this is the main subject of the book.

Hawking's own approach to the unified theory is to combine the general theory of relativity and Richard Feynman's idea of multiple histories. Many related concepts and theories, for example, holography, duality, p-branes, M-theory and superstring theory, are explained. Only in chapter 6, the story is rather close to our life, and here the author also describes excitingly how biological and electronic life will go on developing in complexity at an ever-increasing rate.

I highly recommend this book to laypersons. They will possibly get only a feeling of understanding, not understanding itself; but the book surely opens their eyes more or less about the principles of the universe already found and those on the way to be found. Physical scientists outside Hawking's field might get some frustrations, because advanced concepts at the forefront of research are not conveyed well enough by the everyday language without the aid of the mathematical language suitable for physics.

January 8, 2002

Still Reverberating Conflict

⋆⋆⋆⋆⋆ Boltzmann's Atom: The Great Debate That Launched a Revolution in Physics.
By David Lindley. *Free Press, New York, 2001.*

Ludwig Boltzmann (1844–1906) was an Austrian theoretical physicist and made important contributions to the kinetic theory of gases and thermodynamics. His work was based on the hypothesis of the existence of atoms, and was not accepted by the majority of scientists those days. In the undergraduate physics course, our teacher told us that Boltzmann committed suicide. I wanted to know why he ended his life so sadly, but did not have a chance to learn about it for many years. David Lindley's book gave me a clear answer to my question and much more. I was intrigued by the story about the romance between Boltzmann, a youth "whose energies and thoughts were rarely distracted from physics," and Henriette von Aigentler, a young student at a teacher training college.

The author gives a readable account not only of Boltzmann's life and work but also of work and philosophy of those scientists who opposed his theory, developed a similar theory, or confirmed his hypothesis, namely, James Clerk Maxwell, Wilhelm Ostwald, Ernst Mach, Josiah Willard

Gibbs, Max Planck and Albert Einstein among them. Thus readers can get good understanding about Boltzmann's depressive mood and the significance and greatness of his work. The conflict between Boltzmann's atomic hypothesis and Mach's philosophy that science should be based only on observable facts is discussed especially in detail.

Lindley teaches us that nowadays a similar conflict also exists. Namely, he writes in Chapter 7, "...now some physicists argue for the existence of superstrings and other curious entities that will never be seen directly. It remains, even now, a profound question whether the cost of proposing such very hypothetical objects as superstrings is sufficiently compensated by the benefit in understanding that the hypothesis brings." Here he insists the merit of Mach's critical attitude. In Postscript, however, the author stresses the legacy of Boltzmann's difficult victory over Mach in the modern idea of theoretical physics. Readers are thus made think by themselves about the merit and demerit of Mach's philosophy and physical hypotheses. The book would be interesting to both laypersons and working physicists.

November 24, 2002

Science Approaching Science Fiction

⋆⋆⋆⋆⋆ **Antimatter: The Ultimate Mirror.**
By Gordon Fraser. *Cambridge University Press, Cambridge, 2002.*

Antimatter often appears in science fiction. In Gregory Benford's *Eater*, for example, a robot made by magnetic copying of the heroine flies to the black hole named Eater on a spaceship, carrying an antimatter bomb to change the course of Eater and to prevent its collision with the Earth. In reality, antimatter does not exist naturally on the Earth. Nor has it ever been made in a large quantity in the laboratory.

In 1996 Walter Oelert and coworkers at the European Laboratory for Particle Physics (CERN) in Geneva produced antihydrogen atoms, the first-step thing towards antimatter. Gordon Fraser's *Antimatter* describes the history of physics about the mirror world, in which antimatter has one of the deepest mysteries. First the success of Oelert's team is shortly described. Then the story starts from Galileo Galilei's work and comes to that of Oelert's team again through Paul Dirac's theoretical prediction of the existence of antiparticles and many discoveries by other physicists.

Fraser lucidly narrates to laypersons using neither jargons nor equations. A story about kaons in the chapter of "Broken mirrors" is possibly a little difficult to many readers, but this is a small flaw. Not only laypersons but also physicists can enjoy this book reading anecdotes of many great physicists and exciting episodes of finding antiparticles and producing antihydrogen atoms. In the last chapters the author describes the applications of antiparticles, the riddle of missing antimatter in the Universe and a program to search cosmic antimatter, concluding by the following words that might stimulate would-be scientists: "Our understanding of cosmology and the origin of the Universe would require a major rethink, a Copernican revolution for the twenty-first century."

Antihydrogen atoms of Oelert's team were flying very speedily. Therefore, these were not useful for the measurement of their physical nature. In 2002, however, the ATHENA collaboration at CERN reported the success in the production of many "cold" antihydrogen atoms that move very slowly. Though it is yet quite far from the production of a massive quantity of antimatter, science gradually approaches the science fiction. I wish that this book be revised in the near future by adding the latest advances in antimatter science and by correcting the error of the Japanese physicist Hantaro Nagaoka's first name (now it strangely reads "Hatari" on page 39) as well as a few typos.

April 29, 2003

The Nobel Laureate's Wonderful Insight

⋆⋆⋆⋆⋆ **The Problems of Physics.**
By Anthony J. Leggett. *Oxford University Press, Oxford, 1987.*

The first edition of this book was published in 1988, and this second edition appeared after six years. So, it may be time for the author to publish another new edition. I suppose however that most of the problems described in this edition remain to be challenging and that the book is still worth reading even in the early years of the 21st century, because the author treated the problems of the kind related to deep mysteries of nature. I read this book with great interest and learned much.

The author, Anthony Leggett, shared the 2003 Nobel Prize in Physics with two low-temperature theorists. Thus this book is also good to learn how wonderful insight one of Nobel laureates in physics has not only into the field of his specialty but also into all the fields of physics.

October 9, 2003

Wide and Deep View in the Slim Volume

⋆ ⋆ ⋆ ⋆ ⋆ **Physics and Astrophysics: A Selection of Key Problems.**
By V. L. Ginzburg. *Pergamon, Oxford, 1985.*

In this small book the author attempted to answer the question, "What seems to be most important and interesting in physics and astrophysics at present?" The "present" of the latest edition of the book is the first half of the 1980s. As the author writes in "Preface to the English Edition," the effective lifetime of each edition of the book of this type is not long. Because of the scarcity of books of this kind, however, the author's style and method of presenting an overall view of the situation in physics continue to be heuristic even after many years since the publication of this book.

The book consists of three chapters on macrophysics, microphysics and astrophysics. Each chapter has seven to nine sections that deeply treat specific problems. It would be a good exercise for students and researchers to write about the later developments of the problem they are interested in or to give a list of other important problems they can think of. — The author, Vitaly Ginzburg, shared the 2003 Noble Prize with two physicists. —

October 10, 2003

The Reality Einstein Did Not Admit

⋆ ⋆ ⋆ · · **Entanglement: The Greatest Mystery in Physics.**
By Amir D. Aczel. *Four Walls Eight Windows, New York, 2002.*

In 1935 Einstein, Podolsky and Rosen raised a serious criticism of quantum theory in the form of a paradox (the EPR paradox). The criticism meant that quantum theory brings about a "spooky action at distance" or "entanglement" between quantum subsystems. Two photons generated at a point with a correlation, for example, continue to have the correlation even after being separated by a great distance, and a change in the state of one of them affects the other instantaneously. In 1964 John Bell proposed a mathematical theorem experimentally to test the existence of entanglement. Alain Aspect carried out such an experiment in 1982 to show that entanglement is a reality.

Even one of the greatest physicists in history, Albert Einstein, could not suppose that entanglement would be a reality. So it must be quite difficult to make ordinary person understand it. Amir Aczel tried to do this difficult task in this book, but he does not seem to have well succeeded. Just half of a total of 20 chapters is spent to

describe the history of quantum mechanics, though a short mention about entanglement appears at a few places. Thus the reader who learned quantum mechanics to some extent at least would find the first half of the book rather tedious. From the story of debate between Einstein and Bohr in chapter 11, the book becomes interesting. However, the author explains neither Bell's theorem nor the details of many experiments understandably. On the final page, the author writes the reason of difficulty to understand entanglement as follows: "... the quantum theory does not tell us why things happen the way they do; why are the particles entangled?" Is our expectation to the author too big?

A good point of the book is that it includes biographical descriptions of a lot of physicists related to quantum theory and entanglement. I have learned for the first time that Thomas Young, famous for the double slit experiment, was a child prodigy. Schrödinger's anecdotal "entanglement" with women are also told. A bad point is that writing and printing are made rather carelessly. For example, von Neumann's proof of the non-existence of hidden variable in quantum mechanics and John Bell's later challenge to Neumann's assumption are repeatedly described on pages 101 and 102. There are many typos, and especially the contents of pages 234 and 235 should be interchanged. This error, combined with sudden appearance of the description of Borromean rings on page 232, makes the reader confused around these pages.

November 3, 2003

The Structure of the Physical Universe

⋆⋆⋆⋆⋆ The Fabric of the Cosmos: Space, Time, and the Texture of Reality.
By Brian Greene. *Knopf, New York, 2004.*

Before buying a book newly published, I almost always read reviews on it. However, I bought this book as soon as it was published without following the usual procedure, because the previous book by the same author, *The Elegant Universe*, proved Brian Greene's high ability of clear writing on cutting-edge physics. This new book even exceeded my expectation.

Greene, who made a number of important discoveries in superstring theory, explains about the present understanding of space and time starting from historical ideas from Newton's days and reaching the possible experimental confirmation of extra dimensions predicted by theoretical models as well as future allusions. The book is written for laypersons without using equations in the main text, but includes about 40 pages of notes for the expert reader. Thus scientists and engineers can also enjoy it very much.

The author makes good use of analogies, among which I liked the one about Bell's inequality best. Expert readers may find explanations in earlier chapters a little too

lengthy, but this book has the following instructive feature: Greene's explanation often made me have a small question, but on reading ahead, I found that the author had expected the same question and had given the answer to it in the main text or in a note. I believe that many of the young readers of this book would be interested in becoming a physicist or a cosmologist to study the deep mysteries of space and time.

May 7, 2004

Part III

Vicky: A Novella

Dedicated to Shizuko and the late Seiichi

Sorekara* and *Sanshiro

March 10, 1997

Dear Yosi,

I've read your essay about Soseki's *Sorekara* at your Web site with much interest. Especially it is a good story that a father who liked that novel gave his daughter, a classmate of yours, the same first name as its heroine.

In my senior high school days, the textbook of national language had an excerpt from Soseki's *Sanshiro*. I liked this novel and its heroine, Mineko, very much. The novel also reminds me of a classmate of mine, an intelligent, tall and beautiful girl. Her name was not Mineko, but I cannot think of her without remembering Mineko. You might not have read *Sanshiro*, or, even if you read it before, you possibly do not remember the details of the story. So I'll write its summary below by omitting the temporal background given by Soseki and his critical observations of Japan in the 1900s, though these are important factors for appreciating his work properly.

* * *

Sanshiro, born in a village of Fukuoka Prefecture, comes to Tokyo as a freshman of a university. There he breezes new air of the metropolis, and is acquainted with various people: the physicist Nonomiya (modeled on Torahiko

Terada, whose essays you like), the classmate Sasaki, the higher school teacher Hirota, the painter Haraguchi, and two young ladies of about the same age as he. One of the ladies is Nonomiya's sister, Yoshiko, and the other is a friend of hers, Mineko. Sanshiro sees Mineko for the first time near the pond of the university. She is with a kimono on and has a fan in front of her forehead.

Having lost her parents in her childhood, Mineko has been living with her elder brother and grown up free from old traditions. She allures Sanshiro unconsciously by giving him the words "stray sheep" and sending him a postcard with a picture of two sheep, thus gradually captivating him. However, Mineko gets married to a friend of her brother's. Haraguchi completes a painting entitled "The lady in a wood." The model was Mineko. Sanshiro visits an exhibition to look at the painting, in which Mineko stands in the same pose as seen by him at his first sighting of her. Sanshiro says repeatedly in his mouth, "Stray sheep."

* * *

The memory of the classmate I mentioned is associated not only with Mineko but also with all the other heroines of the novels I read those days, because I was always reading by supposing that the heroine had the same look as hers. In my diary I called her by the nickname Vicky I gave her in my mind. Vicky and I belonged to different homerooms, but in our first year at the senior high school we attended the same classes of lessons except one or two.

I could therefore stealthily look at her during most of my lessons. Her look had something of Venus de Milo.

Moreover, when teachers announced the name of the student who got the highest mark in the examination, it was mostly hers (and less often mine). The letter V of her nickname was thus V of both Venus and Victory. Early in the summer vacation, I sent her a postcard, writing, "You are my good rival, and I should be very glad to compete with you. . . ."

* * *

These days I'm busy in doing some jobs to be completed within this fiscal year. So I'll write the continuation of this story after your moving to Hokkaido.

Wishing good luck to you and your family in Hokkaido,
Best regards,
Minoru

Write to You instead of Sam

April 17, 1997

Hi Yosi,

Thanks for your e-mail message of March 31, in which you told me that you are going to move to Ebetsu on the 20th of this month. I said, "Good luck in Hokkaido" to you too early.

The best of my best friends from my junior high school days died of disease just on the day I sent you my previous e-mail message. After attending the same junior high school for two years, he and I went to different senior high

schools, and exchanged diaries monthly or bimonthly all through the senior high school years. His nickname in my diary was Sam.

I had a business trip to Tokyo at the end of the last month. Therefore, I had been planning to meet Sam during that trip. It would have been a meeting after ten years or more since the previous one. However, I received a phone call from his wife on March 13 about his sudden death to make my plan an impossibility.

Naturally, I wrote much about Vicky in the diaries exchanged with Sam. I was therefore thinking to tell him about what had been happening between Vicky and me these years, but Sam is now in heaven. Thus, you, Yosi, are now the only person to whom I can tell the story of Vicky, continuing it from my last e-mail message. It looks as if God had chosen you as a substitute for Sam to listen to my talk about her.

* * *

I waited and waited for Vicky's response during the summer vacation, but nothing came from her. The second term began. I saw her again in the same classes of lessons, but she did not speak to me, nor did I to her. Thus I began to have a little of hostility to her as well as respect for her—ice and fire at the same time—.

One afternoon Vicky and some of her friends were walking a few meters behind me on our way from school. The road was covered by half-melt snow mixed with mud. They were talking about a new movie. Then I overheard Vicky say "I want to see that movie at any cost! I must go see

it!" The Japanese word for *must* is rather long, so that in a conversation we almost always use one of its shortened forms. However, she unusually said the word in its formal style.

Hearing the formal word she used, I felt that I had been insulted, because I remembered that I had wrote this word too many times in my postcard to her. At the same time I was glad to think that she remembered something of my postcard. It was possible however that her utterance of the word had no relation to the postcard and that my heart was too sensitive to what she said.

Just a "Good-bye"

April 17, 1997
To Yosi (Continued)

In our second year I made a rather peculiar choice of lessons to prepare for the entrance examination to the university together with a few of my friends, taking analysis II, physics, etc. Vicky, who lost her father in her childhood like Mineko, Sanshiro and me, was not wishing to go to university, at least just after finishing high school. Thus she and I had never been in the same lessons in the last two years of the high school.

At the completion ceremony of the high school Vicky was the valedictorian, and sat at the right front corner. I was to receive T Prize, and my seat was prepared next to her. T Prize was an honor given to ten students prospec-

tive in the field of chemistry from all the high schools in our prefecture. She and I, sitting so closely, did not speak to each other. In that evening, my mother, who had been one of the parent participants at the ceremony, told me that Vicky (of course, my mother did not call her by this nickname but by her real name) had been trembling possibly from a strain.

Once or twice during the ceremony I glanced at Vicky's shapely legs. These were joined in a delicate curve onto her feet, tips of which in turn vanished into black shoes of the type worn by adult ladies. However, I did not notice her tremble. I believed that if she had had any tremble, its cause might have been the coldness of the school hall that morning. Vicky was rather thin and must have been difficult to stand the cold. Some years later, one of our teachers told me that Vicky had had old newspapers around her belly to make herself seem not so thin when she had attended a personal interview for employment.

On returning home after the completion ceremony, I found a letter from Dr. J. T. Memorial Association. It told me that a stamp was missing on the T Prize certificate and that I had to bring it to the Association at the City Library. It was one of rare fine days in the early spring of the northern town, and the time of the day was early afternoon. I walked to the Library. It was a walk of about thirty minutes one way. The return path I took happened to be Vicky's regular path to and from school (I lived nearer to the school). Part of the path was a long and gentle slope, having a stream on one side far down below.

At the middle of the slope, I saw Vicky walking toward

me. She was just coming back from school belatedly. I was at a loss without finding what to do. Which of us should greet first, she or I? ... Then she made a polite bow, saying nothing. I said, "Good-bye." Just a "good-bye" on the day of our departing. This was the only exchange between Vicky and me during our high school days. I still remember how she, in a light-blue overcoat, bowed to me. I walked the rest of my path by feeling that the small ice in my mind was melting away.

* * *

Why was the exchange between Vicky and me this minimum? My shyness was one of the reasons for this, but there were more reasons. First, in our old castle town after several years since the end of the Second World War, there remained one of feudalistic ideas of regarding the conversation between a boy and a girl of adolescent ages as a bad thing. Second, without receiving Vicky's response to my postcard, my pride refused any trial of my speaking to her. I will write later about the possible presence of one more reason.

Sam knew none of the episodes given below. Vicky worked for some years at a branch of N Bank in the hometown. During my university days in Kyoto, I heard that she had gotten married to a medical scientist, and had moved to Tokyo. I thought that her husband was possibly much older than I. This is a similarity between *Sanshiro* and my story of Vicky (I will write about this again). Later I also heard that after her sons being grown up, she had studied at a university.

Reunions

April 17, 1997
To Yosi (Continued)

After thirty-five years or so from finishing high school, I attended an alumni meeting held in the home town, and saw Vicky unexpectedly. I sat at the table far from hers, but she came to greet me. She was outstandingly shining in a crimson suit. We had a little bit of courtesy talk, and attended a party after party together with many of our friends. At that party, however, I was again a shy boy of high school days. Only when she stood up to go back to hotel, I said to her, "I wish to talk more with you someday." She replied simply, "Possibly in Tokyo."

About a month later, I was in a bullet train from Shin-Osaka to Tokyo. It was on my way to Atomic Research Institute in Tokai. Near Tokyo I made a phone call to Vicky, and asked her if we could meet on my way back. She said like a heroine in Soseki's novels, "Do we have anything to talk about?" I said, "Nothing especially, but ..." I did not know what I wished to talk with her. Possibly I wished to grow out of the dream that I had dreamt sometimes, a dream in which I was a schoolboy struggling to talk with her in vain. Then she told me that she had had a throat cancer and went to hospital still regularly. Vicky, who looked so young and beautiful, had suffered from a cancer! It was a

shock to me. I promised that I would phone her up again from Tokyo on my way back. In my second phone call I gave her some words by which I wished to enliven her, but am not sure if these were really something to her.

* * *

Our classmates living in the Eastern District have a reunion each year in Tokyo. Since I had talked with Vicky by phone, I attended such meetings twice, by going a long way from Osaka. She was also there and seemed to have recovered from her disease completely. I had only a little talk with her each time, but was happy to look at her pleasantly talking with friends. At one of the meetings she was with an elegant kimono on like Mineko in the painting "The lady in a wood."

She told me that K-san[1], a friend of hers, had been suffering from a heart disease. I remembered that U-kun[2], who was also at that meeting and had been one of the best high school baseball players in the Northern District, liked K-san very much in our elementary school days. I told this to Vicky. Just then U-kun passed by us. Vicky stopped him and told him about K-san's suffering. U-kun made a porker face, and wondering why Vicky told him about K-san, said, "Eh?" Vicky looked at me and laughed a laugh of a mischievous girl. I returned her a smile to congratulate the success of our cooperative mischief and the young mind of Vicky, a mother of two grown-up sons.

[1] *San* is a Japanese word to mean Ms. or Mr. In the present case, it means Ms.

[2] *Kun* is a Japanese word to mean Mr., and is used when a person (usually a male) calls a boy, male friend or comrade.

At the same meeting, Vicky asked me if the radiation treatment she had gotten would cause another illness later. Being a radiation physicist, not a physician, I could not give her a sure answer at once. Next morning I phoned her from the hotel where I stayed to tell her what I thought out in the night before, assuring that such would not happen. However, she wrote on her latest New Year card that she was suffering the damage of the gum as an aftereffect of the treatment. On my last business trip to Tokyo, I called her from the hotel to talk about the effect of radiation treatment and what I learned recently about the latest technology in radiation therapy. Regrettably our topic was not a merry one, but hearing her ever-joyous voice soothed me.

The New Year Card

April 17, 1997
To Yosi (Continued)

A few years after beginning to receive a New Year card from Vicky, I reminded myself of a *senryu*[3] I had found in my student days, and suddenly understood its correct meaning. It was placed at the closing of a New Year essay in a local newspaper, and read:

> Gajo kinu mukashi no koi wa sarigenaku.

This can be translated as follows:

[3] *Senryu* is a satirical poem of the Japanese style that consists of 17 syllables.

A New Year card has come from my ex-lover,
Written in a casual manner
Without any hint of past days.

When I found this poem, I thought *konu* was the right reading for the second word, instead of *kinu* (has come). Both *ko* and *ki* are possible ways of reading the Chinese character used here. When we adopt *konu*, the phrase, *gajo konu mukashi no koi*, means "the old love the partner of which does not send me New Year cards." Then the meaning of *sarigenaku* does not fit in the context, but somehow I interpreted the poem as this: "Even a single New Year card did not come from her; my old love was such a transitory one." Vicky's cards corrected my wrong reading, though I had never thought that my feeling to her had been "love."—It would be a difficult task to tell her this last episode.—Anyway, this indicates that experience is another teacher in our life.

* * *

As written above, I have believed that my feeling to Vicky has been nothing but great fondness and respect, at least at the conscious level. One of the reasons for this belief is that I guessed the following: She is the type of girl who would marry a man much older than she, similar to Mineko who got married not to Sanshiro but to a friend of her elder brother's. Another reason is that I had a tendency of becoming, or wishing to become, friends with some of the cleverest classmates irrespective of gender. Sam was one of such friends. I have also such female friends from

elementary and junior high school days. Thus I wished Vicky to be one of such friends.

At the ages of the senior high school student, namely the ages of adolescence, however, it was possible that I had unconsciously something more than fondness and respect to her to make her notice it (remember that I secretly looked at her during lessons), and this might have been one of the reasons for that a simple friendship between Vicky and me could not be established in our high school days.

When I speak of unconsciousness, I remind myself of the words "stray sheep," which Mineko gave to Sanshiro, as well as Soseki's main theme in *Sanshiro*, "an unconscious hypocrite" (this interpretation of the main theme was described by Toyotaka Komiya in his review of that novel). Mineko was an unconscious hypocrite in the sense that she allured Sanshiro and loved him unconsciously. Mineko also drew two sheep on a postcard sent to Sanshiro, suggesting him that both of them were stray sheep. In my high school days I might have been both a stray sheep and an unconscious hypocrite by making myself believe that what I had at the conscious surface was all of my feeling to Vicky. To be a stray sheep might be one of the privileges of the youth.

Sorry for writing such a long message. Now it seems to be the time to say, "Good luck in Ebetsu" to you and your family.

Regards,

Minoru

Stupid Idea?

May 2, 1997

Hi Yosi,

How is your life in Ebetsu?

I am thinking to modify my e-mail messages addressed to you to make them a novella, but have found that I lost the copy of the first of them. If you happen to preserve it, please send it back to me when you write me next.

Regards,

Minoru

* * *

May 8, 1997

Hi Yosi,

Nice to hear from you now in Ebetsu. It sounds great to live in such an environment that is friendly to children. I wish that your new company would have a good start.

Thanks for the copy of one of my own e-mail messages to you. After modifying and editing all of them, I will send you the result, *Vicky: A Novella*. I suppose that Vicky herself could be one of the readers of this novella. Is this a stupid idea?

Here we are having hot days like the end of June or the beginning of July.

Best regards,
Minoru

* * *

May 23, 1997

Hi Yosi,

At your Web site I have found that many things now have a new look. I wish to make my own Web site in the near future.

I have completed editing *Vicky: A Novella*, and a copy is appended below.

In the column "Words to Remember" in the May 18 issue of *Asahi Weekly*, I found the following lines quoted from Edward Thomas's poem "October":

> Some day I shall think this a happy day
> And this mood by the name of melancholy
> Shall no more blackened and obscured be.

It seems that I have arrived at this "some day," remembering the melancholy of young days happily.

Thanking you for that your essay on *Sorekara* gave me an opportunity to write this novella,

Best wishes,
Minoru

. . .

Vicky: A Novella

Dedicated to Shizuko and the late Seiichi

Sorekara* and *Sanshiro

March 10, 1997

Dear Yosi,

I have read your essay about Soseki's *Sorekara* ...

* * *

Note: An obedient reader should go from here to the top of this novella, because the lines attached to the last e-mail message above are those starting there. Then the reader will come to this note again and have to go back to the top for the second time, and so on, being trapped in this novella forever. *Vicky* is a never-ending story. Sam would have liked this trickery.

Index

About the Author

Tatsuo Tabata was born in Kanazawa, Ishikawa Prefecure, Japan, on April 17, 1935, as the third son of Kunika and Chiyoko (Kawamura) Tabata. He married to Teiko Murata on November 6, 1960, and has two daughters, Yuko and Yasuko. He got the degree of Bachelor of Science in 1958, Master of Science in 1960, and Doctor of Science in 1967, all from Kyoto University (Japan). He worked at the Radiation Center of Osaka Prefecture, Sakai, from 1960 to 1990, became professor at Osaka Prefecture University, Sakai, in 1990 and emeritus professor in 1999. He has contributed more than 90 articles to more than 20 professional journals in the fields of computers, pure and applied physics, radiation physics, medical physics, nuclear engineering, biology and psychology.

The sources of the two quotations in Preface are:

A. The Constitution of Japan, Article 9.
B. Barack Obama's Prague Speech on Nuclear Weapons (April 5, 2009).