

Effective Methods for Training Japanese Industry Research Engineers to Write Proper Technical Papers in English

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Abstract

This paper describes twenty-five-year experience of how I have been training Japanese research engineers in industry research laboratories to write proper technical papers and conference abstracts in English so that their papers and abstracts can be easily understood by native speakers of English. Since almost all these engineers have not been taught how to write technical papers in English, they try to translate from their Japanese research papers into English in a word-for-word fashion using Japanese-English dictionaries, resulting in poorly organized English. I have rewritten their papers according the following rules: (1) Stating conclusions first, then stating causes or giving explanations. (2) Following the three-step English writing style of introduction, body, and conclusion, instead of following the four-step Japanese writing style of ki-sho-ten-ketsu. (3) Translating from Japanese to Japanese first, and translating it into English. Most of the revised papers and abstracts have been accepted by journal editors or program committees of international conferences. In addition to training individual engineers on their writing, I have been teaching technical writing in English (English for Science and Engineering) at Hitachi's R&D Division and at Hitachi Institute of Technology using materials developed during my tenure at Hitachi.

Keywords: Direct translation from Japanese to English, English three-step style of introduction, body, and conclusion, Japanese four-step style of ki-sho-ten-ketsu, Leggett's trees.

Introduction

For research engineers in industry research laboratories in Japan, writing technical papers and conference abstracts [1-5] is one of the important activities. When they decide to write, they have already

written internal research reports in Japanese intended for managers and engineers in the production divisions. Since they are not taught how to write English technical papers, they try to translate all the sentences in their Japanese manuscript directly into English in a word-for-word fashion using Japanese-English dictionaries. Then they come to me with their manuscripts asking me to check the English. Unfortunately, their manuscripts written in this "Japanese-English" style are difficult to understand or sometimes are misunderstood by English-speaking engineers because of the following differences in the writing styles. In English, conclusions come first and then explanations, while in Japanese, explanations come first and then conclusion; The writing style of English is three steps, introduction, body, and conclusion, while the writing style of Japanese is four steps, ki-sho-ten-ketsu (introduction, development, turn, and conclusion).

To improve English in their manuscripts, first I ask them to sit next to me and to describe the contents of their papers, in particular the most important points. Then, I rewrite the whole manuscripts in the English style described above. While working on the manuscript, I often have to ask the following questions to clarify their intentions: "What is the subject of this sentence?", "What do you really want to say in this sentence?", and "What do you mean by this word?" Other important items to be checked are articles ("a" or "the"), countable or uncountable nouns, singular or plural forms, and prepositions. Although these are not explicitly written in the original Japanese manuscripts, they should be clarified in the English manuscripts. After going through these, English of all these manuscripts are checked and corrected by an American chemistry Ph.D. before submission. Because of these procedures, most of the papers have been accepted.

In this presentation, I will describe characteristic attitudes of research engineers in industry research laboratories in Japan in writing technical papers in

English and give tips for their writing improvements in English.

Characteristic attitudes of Japanese engineers in industry research laboratories towards English

Japanese engineers in industry research laboratories have studied English at least eight years, three years at junior high school, three years at senior high school, and two years at college in liberal arts studies. They have been reading a large number of technical papers in English for their research and development. Regarding writing, they have only learned English composition, i.e., they translate Japanese short sentences into English equivalents using Japanese-English dictionaries. Therefore, Japanese industrial engineers can manage the sentence-level grammar and syntax of written technical English. However, they are much less skillful in managing the design of technical papers on structural levels beyond sentences. They can write technical papers that are composed of correct sentences but fail to connect those sentences into effective patterns of arrangement. Sentences are not logically sequenced and paragraphs lack clear unity and coherence. As a result, many technical papers written by Japanese engineers pass the test of grammatical correctness but fail the more important test of effectiveness: they fail to communicate. This is because Japanese engineers are generally not trained in technical writing in English: they have learned principles of writing largely through reading technical papers and through imitation of the style of those technical papers. Furthermore, they have not received explicit instructions of the technical paper styles in either English or Japanese. In addition, Japanese engineers tend to write technical papers in English through Japanese styles and structures.

- ① Under the following crystal preparation conditions (followed by details of the conditions in several lines),
- ② the crystals were obtained by using the AAA crystal manufacturing method (followed by details of this method in several lines).
- ③ Using a certain experimental apparatus, ④ under the following experimental conditions (followed by the details), ⑤ we measured certain quantities of these crystals using the BBB experimental method.
- ⑥ The purpose of this experiment was CCC.

Fig. 1a Experimental procedure in the Japanese-English presentation style

- ⑤ We measured certain quantities of the crystals XX using the BBB experimental method ③ with a certain apparatus ④ at the following experimental conditions (temperature, pressure, etc.).
- ⑥ The purpose of this experiment was CCC.
- ② The crystals studied were obtained by the AAA method ① at conditions of (crystal preparation conditions)

Fig. 1b Experimental procedure in the English presentation style

For example, Japanese engineers express their conclusions at the end of the technical papers, while English native speaker engineers would expect a more direct expression on writer's thinking at the beginning of the technical papers. One example is shown in Figs. 1a and 1b; Fig. 1a shows a description of a certain experimental procedure in the Japanese-English style and Fig. 1b shows an English version of the same experimental procedure. Numbers (1) through (6) in Fig. 1a indicate the order of the Japanese presentation style, while in Fig. 1b the order of presentation is changed to follow the English presentation style.

Correction and coaching procedures of technical papers or abstracts

When I joined Hitachi Research Laboratory in 1982, the Manager of the 9th Department asked me to check and correct papers in English written by research engineers of the department, because I had worked as a postdoc in the US for four years at the University of Illinois and Case Western Reserve University and published 15 scientific papers. The research conducted in the 9th Department consisted of electric power-related technologies, electronic devices, and flat panel displays. This job was an additional one besides my main research on flat panel displays; I worked on this in the evenings and weekends.

Later, research engineers of other departments started to come to me asking for correction of English in their technical papers. They included electrical and electronic engineers, computer science engineers, semiconductor engineers, materials engineers, process engineers, chemical engineers, and mechanical engineers.

Their technical papers and extended abstracts in English had and still have the following features: Meaning of sentences the authors intended can be usually guessed, but in order to understand the true meaning, a large portion of the original manuscript have to be revised and rewritten. Technical terms in their own fields are

properly used, but most sentences have flavor of Japanese way of thinking with full of incorrect use of articles and of grammatical problems. Although each sentence is grammatically correct, it is difficult to grasp the meaning of series of sentences.

These problems are caused by direct translation from Japanese to English. To remedy these problems, one has to go back to the original papers or abstracts in Japanese and has to read them carefully several times or one has to ask the authors to explain the meaning of certain sentences that are difficult to understand. After these procedures, one can understand what the authors really want to say. This means one has to rewrite the original Japanese into another style of Japanese with an English grammatical structure before one can translate it into proper English. All these procedures can be called a process of “translating from Japanese to Japanese first, and then translating it into English”.

Seminars on technical writing in English

Soon after I started correcting papers written by these research engineers, I decided to train them through seminars and lectures. For that purpose, I read books on technical writing in English written by Japanese scientists and engineers [6-8] as well as by English native speakers. [9-12] In addition, I developed an effective method based on my experience in my postdoc experience at Case Western Reserve University. During my stay there in 1979-1981, I published 13 technical papers. Every time I wrote a manuscript, I asked Professor Stefan Machlup to look over and correct my English, regarding sentence structures and paper styles. For each technical paper, we conducted this procedure several times, before we were satisfied with the final manuscript. This experience taught me a great deal how to write good technical papers. I wrote down all these sentences with corrections in notes and later used these as guides in writing technical papers and correcting English in these papers.

I started training research engineers through seminars and lectures in 1982 at the Hitachi Research Laboratory, and extended them to other research laboratories and production divisions until I left Hitachi in 2005. Even after that, I have been training Hitachi research engineers at “technical writing two-day seminars” twice a year at the R&D Division and once a year at Hitachi Institute of Technology. Based on these lectures, I have published three books on technical writing. [4-5, 12]

In these seminars and lectures, the following four rules are stressed for improving technical writing in English, [4-5, 13-15]

- (1) State your conclusions first, then state causes or give explanations.
- (2) Follow the English writing style of introduction, body, and conclusion, i.e., follow the “Tell them

three times approach. Do not follow the Japanese writing style of “ki-sho-ten-ketsu.”

- (3) Translate from Japanese to Japanese first and then translate it into English. Do not translate directly from Japanese to English.
- (4) Write sentences in an English-way-of-thinking style. Write English following the Leggett’s trees.

These rules have remedied the problems of Japanese industry research engineers in writing English technical papers.

Differences in Japanese sentence structure vs. English sentence structure

Since the writing styles of Japanese and English are different, one must follow the English style in writing in English. In Japanese, reasons (causes) come first, followed by the conclusion. On the other hand, in English, the conclusion comes first, followed by reasons (causes) or explanations. This is shown in Fig. 2. [16]

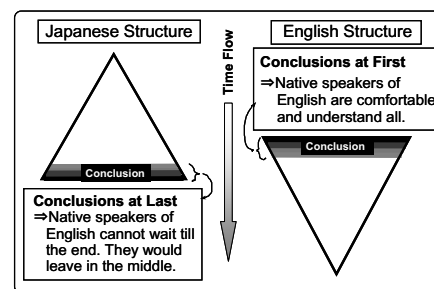


Fig. 2 Japanese sentence structure (Δ) vs. English sentence structure (▽)

When one writes one’s papers in English in the Japanese style with the conclusion coming at the end, native speakers of English will stop reading the papers in the middle because they cannot understand or guess what one is getting at.

English writing style in three steps vs. Japanese writing style in four steps

The English writing style of introduction, body, and conclusion [2,4,5] is often called “Tell-them-three-times approach.” In the introduction, “tell them what you will tell them,” in the body, “tell them,” and in the conclusion, “tell them what you told them.” The important point is that the conclusion is stated at the beginning of the introduction.

The Japanese writing style, on the other hand, is in four steps: *ki-sho-ten-ketsu* (introduction-development-turn-conclusion) [4-5, 16-17]. In this style no conclusion is

stated in the introductory “*ki*” part; only the topic is introduced. In the following “*sho*” part, the explanations regarding the topic are given. In the “*ten*” part, a completely unrelated topic is introduced and in the “*ketsu*” part conclusions are stated. If Japanese technical papers written in this *ki-sho-ten-ketsu* style are directly translated in English, native speakers of English would be puzzled because of the following reasons: no conclusion is given at the beginning, an unrelated topic in the “*ten*” part is puzzling, and the conclusion in the “*ketsu*” part is not what they consider a conclusion at all.

Therefore, these Japanese technical papers must be reformulated into the English three-step style before translation.

Translation from Japanese to Japanese first, and then translation into English

As discussed above, when research engineers have to write technical papers in English, first they write them in Japanese and then try to translate them into English, because they are so accustomed to the word-for-word Japanese-to-English translation exercises they studied for their college entrance examinations.

Since the Japanese writing style is different from the English writing style, it is often stressed that one should write one’s papers in English from the beginning and not try to translate from the Japanese version. This is easy to say, but difficult to do. If one has to translate from Japanese, one should first translate the original Japanese into a different form of Japanese that has the following English writing style [4-5, 13-14]:

- (1) Every sentence must have a subject, a corresponding verb, and an object.
- (2) Only one result or one cause should be stated in one sentence.
- (3) Sentences must be placed in the English order of reasoning.

After this procedure is completed in Japanese, one should translate each sentence into English. This is called a “two-step translation”.

Leggett’s trees of sentence structures and flows

The sentence structures in technical papers also differ. In 1966, Leggett [12] clearly showed the differences in his article “Notes on the writing of scientific English for Japanese physicists” in “*Butsuri*,” a monthly journal of the Physical Society of Japan. In this article, Leggett introduced “Leggett’s Trees” to clearly describe the different sentence structures and flows of English written by Japanese scientists and English scientists. This article became one of the “must-read” articles for young Japanese engineers and scientists before writing technical papers in English. The Leggett’s trees are shown in Fig. 3.

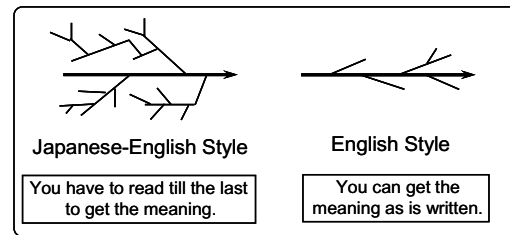


Fig. 3 Leggett’s trees of sentence structures and flows for Japanese-English style and English style

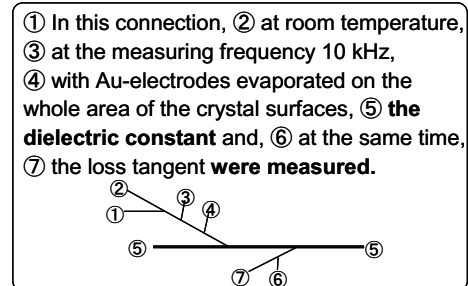


Fig. 4a Experiment description in the Japanese-English style

① Measurements were made on the dielectric constant of the crystal ② at 10 kHz, ③ with electrodes evaporated on the whole area of both surfaces, ④ at room temperature. ⑤ The loss tangent was simultaneously measured.

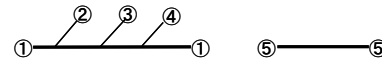


Fig. 4b Experiment description in the English style

Examples of Leggett’s trees are shown in Figs. 4a (Japanese-English style) and in Fig. 4b (English style).

In these figures numbers preceding phrases or sentences corresponds to the numbers in the Leggett’s trees shown below. These figures clearly show the difference: Figure 4a depicts a complicated sentence structure with the subject appearing almost at the end. On the other hand, Figure 4b depicts a simple sentence structure with the subject (Measurements) coming at the beginning directly followed by the corresponding verb (were made) so that it is easy to understand the meaning of the sentence. Therefore, Japanese engineers should write technical papers in English in the English style shown in Fig. 4b.

Conclusion

I have discussed effective coaching and teaching methods for Japanese engineers in industry research laboratories to write proper technical papers and conference abstracts in English. I have encouraged them to write technical papers in two steps: first, translate from Japanese to other forms of Japanese, and then translate it into English. Other rules for improving their English are as follows: (1) State your conclusions first, then state causes or give explanations. (2) Follow the English writing style of introduction, body, and conclusion, instead of following the Japanese writing style of “ki-shoten-ketsu.” (3) Write sentences in an English-way-of-thinking style, i.e., write English in the Leggett’s tree English style.

Following these rules, these engineers have revised their papers. The result is that more than 100 revised papers have been accepted by journals and international conferences of the following societies: IEEE Electron Devices, IEEE Power Electronics, IEEE Power Engineering, IEEE Solid State Circuits, American Physical Society, American Chemical Society, Materials Research Society, Electrochemical Society, and Society for Information Displays.

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