

The Japanese Language : Its Role in Science in Japan

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Ladies and Gentlemen!

It is my great pleasure to speak to you this evening. I used to come to this series of conferences, but at present I am not active in scientific research, because my present duty as President of Saitama University takes much of my time. However, to contribute to this Conference in a way other than by delivering a paper, I accepted the Organizing Committee's request that I should give an after-dinner talk at this Banquet.

Now I will turn to my today's subject. In Japan, science education at all levels from primary school to university is usually conducted only in Japanese. Practically all technical terms in major Western languages have corresponding Japanese terms. This is the result of great efforts to understand all aspects of Western civilization and to express them in Japanese. Such efforts began about 150 years ago with the opening of Japan to the outside world after a long period of national seclusion, and are still continuing today.

Japanese undergraduate students studying natural science may read the translated versions of major textbooks used in the USA and UK. Few students read original textbooks in English, although they are probably advised to do so by their teachers. As far as the language in science education is concerned, Japan is a completely self-contained country. Later, I will discuss whether or not such situation should be changed to advance scientific research in Japan.

Now I will tell you briefly about the Japanese language. Today, three kinds of letters are used in Japan, namely, *kanji* (Chinese letters), *katakana*, and *hiragana*. *Katakana* and *hiragana* are different scripts of the Japanese alphabet. To explain how these three kinds of letters came into use, I have to touch on the history of the Japanese language.

The description of the Japanese language in *Wikipedia*, the free encyclopedia on the Internet, may be summarized as follows.

“Historical linguists agree that the Japanese language is one of the two

members of the Japonic language family, the other member being Ryukyuan spoken in Okinawa. The genetic affiliation of the Japonic family is uncertain.

Numerous theories have been proposed, relating the Japanese language to a wide variety of other languages, including the Altaic languages (Turkic, Mongolian, Tungusic, etc.) and the Austronesian languages spoken in islands in the central and southern Pacific Ocean. It is also often suggested that it may be a creole language combining more than one of these. At this point, no one theory is generally accepted as correct, and the issue is likely to remain controversial.”

The above description is rather tantalizing, but one thing is clear. The Japanese language does not belong to the Sino-Tibetan language family. In other words, the Japanese language is not linguistically close to the Chinese language. Then, you may ask why *kanji* (Chinese letters) are used in the Japanese language.

Until the 3rd or 4th century, the Japanese had no written language. When the ancient Japanese felt the need to write, they decided to use *kanji* to express their language, instead of creating their own letters. This decision reflected the overwhelming influence of China, which was much more civilized than Japan in those days.

However, since the original Japanese language differed greatly from the Chinese language, the ancient Japanese felt much inconvenience and struggled very hard to adapt *kanji* to express Japanese words. At the same time, many Chinese words were imported into the Japanese language with their Chinese pronunciation.

After various attempts over several hundred years, the Japanese worked out *katakana* and *hiragana*. Both of them were derived from *kanji*, and have about 50 basic letters. They are phonetic or syllabic symbols, in contrast to *kanji*, each of which represents a meaning (i.e., ideogram).

ア	阿 a	イ	伊 i	ウ	宇 u	エ	江 e	オ	於 o
カ	加 ka	キ	幾 ki	ク	久 ku	ケ	介 ke	コ	己 ko
サ	散 sa	シ	之 shi	ス	須 su	セ	世 se	ソ	曾 so
タ	多 ta	チ	千 chi	ツ	川 tsu	テ	天 te	ト	止 to
ナ	奈 na	ニ	仁 ni	ヌ	奴 nu	ネ	祢 ne	ノ	乃 no
ハ	八 ha	ヒ	比 hi	フ	不 fu	ヘ	部 he	ホ	保 ho
マ	末 ma	ミ	三 mi	ム	牟 mu	メ	女 me	モ	毛 mo
ヤ	也 ya			ユ	由 yu			ヨ	與 yo
ラ	良 ra	リ	利 ri	ル	流 ru	レ	礼 re	ロ	呂 ro
ワ	和 wa							ヲ	乎 wo
ン	尔 n								

Figure 1. The *katakana* syllabary

<i>Katakana</i>	<i>Kanji</i>	<i>Pronunciation</i>
イ	伊	i
ウ	宇	u
エ	江	e

Figure 2. Relation between *katakana* and *kanji*

あ 安 a	い 以 i	う 宇 u	え 衣 e	お 於 o
か 加 ka	き 幾 ki	く 久 ku	け 計 ke	こ 己 ko
さ 左 sa	し 之 shi	す 寸 su	せ 世 se	そ 曾 so
た 太 ta	ち 知 chi	つ 川 tsu	て 天 te	と 止 to
な 奈 na	に 仁 ni	ぬ 奴 nu	ね 祢 ne	の 乃 no
は 波 ha	ひ 比 hi	ふ 不 fu	へ 部 he	ほ 保 ho
ま 末 ma	み 美 mi	む 武 mu	め 女 me	も 毛 mo
や 也 ya		ゆ 由 yu		よ 与 yo
ら 良 ra	り 利 ri	る 留 ru	れ 礼 re	ろ 呂 ro
わ 和 wa	ゐ 為 i		ゑ 惠 e	を 遠 wo
ん 无 n				

Figure 3. The *hiragana* syllabary

The *katakana* syllabary is shown in Figure 1, which also shows how *katakana* is related to *kanji*. A part of a *kanji* letter was used as a *katakana* letter to express a sound similar to that of the *kanji* letter. Three examples are shown in Figure 2. The red part of the *kanji* letter was used as the *katakana* letter.

The *hiragana* syllabary is shown in Figure 3. I will not go into details of the correspondence between the *hiragana* and *kanji* letters, because it is not as simple as that between the *katakana* and *kanji* letters.

(The author gratefully acknowledges that the descriptions on *katakana* and *hiragana* in *Wikipedia* were helpful in preparing Figures 1-3.)

Katakana and *hiragana* are different scripts of phonetic symbols. Any Japanese words can be expressed in either of them. Most words in Western languages can also be expressed in either of them to a satisfactory degree. In modern Japanese writing, foreign names and words are usually expressed in *katakana*.

For example,

- (1) Sandy Asher = サンディ・アシャー
 Jim Durig = ジム・デューリック
 Wolfgang Kiefer = ヴォルフガング・キーファー

Janos Mink = ヤノシュ・ミンク

(2) Spectrum = スペクトル (su-pe-ku-to-ru)

In this case, it is difficult to create a Japanese word in *kanji*, so *katakana* is used to make this word スペクトル (su-pe-ku-to-ru) which has a pronunciation closer to the French word 'spectre' rather than 'spectrum'.

Kanji is more useful than *katakana* and *hiragana* to represent technical terms, because the Chinese letters have the advantage of being ideograms. This advantage has been fully utilized to translate technical terms from English into Japanese. I will show you only three examples.

(1) Chemistry = 化学 (ka-gaku)

化 (ka) = change, 学 (gaku) = a branch of science (or knowledge)

The use of 化学 (ka-gaku) for chemistry began in China in 1855, and this Chinese word was imported into Japan in 1860.

(2) Spectroscopy = 分光學 (bun-ko-gaku)

分 (bun) = separate, 光 (ko) = light, 学 (gaku) = a branch of science (or knowledge)

Probably 分光學 (bun-ko-gaku) was a word created in Japan around 1880. It is now used also in China, although Chinese pronunciation is different.

(3) Resonance Raman scattering = 共鳴ラマン散乱 (kyo-meī Raman san-ran)

共鳴 (kyo-meī) = sound together (resonance), 散乱 (san-ran) = scatter in disorder

I remember that we began to use the word 共鳴ラマン散乱 (kyo-meī Raman san-ran) in the late 1960's when interest in resonance Raman scattering increased enormously all over the world.

As I told you earlier, science education in Japan has been carried out only in Japanese. I feel that this way of education is effective for making Japanese students understand the important concepts of science. However, there is a drawback also. On an average, students' command of English is not satisfactory. In the present world of globalization, English enjoys the position of the international language of science. Research activities are increasing all over the world not only in quantity but also in speed. It is absolutely necessary for a scientist to be able to communicate fully and

quickly in English.

In such circumstances, the present method of science education in Japan may become irrelevant or inefficient. At present, I do not have any good suggestion on how to change the present method, but I feel that we must find a solution for the problem of how to keep up with the trend of the world. On the other hand, I also feel that to worry about the future of science education simply shows that I am aging. In my opinion, optimism has been one of good Japanese traits. To be optimistic may be the best policy for solving the difficulty.

Before closing my talk, I would like to point out that the language used in science education may greatly influence the quality and outcome of scientific research. I am interested in a possibility that a certain relationship may exist between scientific ideas and languages in which scientists hit upon the ideas. Language is a tool with which we think. I will think more about this possibility, and would like to give a talk on it, if I have a chance in the future.

Thank you for your attention.

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