Scientific Translation and its Social Functions: a Descriptive-Functional Approach to Scientific Textbook Translation in China

Fan Xiangtao, Nanjing University of Aeronautics and Astronautics, Nanjing, P.R. China

ABSTRACT

From 1900 to 1911, a large number of scientific textbooks for primary and secondary schools from foreign countries were translated into Chinese for the purpose of introducing science education in China. These translated books have since exerted a great influence on the Chinese society. Adopting the descriptive-functional methodology and with reference to statistical analysis, this paper describes and examines this translation phenomenon, including the historical-cultural context which affected and constrained the translation selections of such textbooks, the translating process, and their criticism and social functions. The paper concludes that translated scientific textbooks influence both the surface and deep structures of Chinese traditional culture, and that their criticism should be integrated into the cultural background in order that the criticism becomes more inclusive, scientific and objective.

KEYWORDS

Translation, scientific textbooks for primary and secondary schools, history and culture, translation criticism, translation selection, social functions

1. Introduction

China's traditional culture has witnessed two major changes. Both were induced by the impact of foreign cultures, partly as a result of large-scale translation activities. The first one involved the translation of Buddhist Scripture starting from the Han Dynasty (25-220). The second one was related to scientific translation undertaken on an extensive scale in the early 20th century. The latter was led by the translation of scientific textbooks. As G. Toury suggests, "most texts were selected for ideological reasons" (cited in Gentzler 1993: 126). Though the translation of scientific textbooks surged at that time, the historical elements, conditioning the selection of the translations, shaped themselves after the Sino-Japanese War in 1894. The War shocked the whole Chinese society who came to realise the importance of introducing western knowledge to China and the necessity of reforms. An examination of the dominant ideological factors of the times can serve to provide a general picture for the understanding of the motivation for the translation selections at the macroscopic level, such as the purposes of the translation, the translator's cultural stances and strategies, and for the investigation of the cultural functions of these translation activities.

2. Saving China by science— historical background

The Chinese Foreign Affairs Movement (1860-1894) came to an end upon the military defeat of China in the 1894 war. During this period, the doctrine advocated and prevailing in China was "Chinese learning as the foundation and western learning for the application". It was used as a guideline for the purpose of introducing western technologies to China. However, the result of the war exposed the historical limitations of such a doctrine. The translation for the purpose of "making the country rich and strong" was reduced to a visionary hope. The effect was so considerable that "the noise of the cannons in 1894 shattered into pieces the nice dreams of the

numerous ministers from the School of Foreign Affairs and also acutely shocked the age-old heart of the Chinese people"(Gao, et al 1992: 5). Yan Fu (1854-1921), the great translator and enlightener in modern China, published five papers within three months from early February to early May in 1895 (Yan 1986: 1-40)1. In one of those papers, he proposed the well-known guiding principles for saving the Chinese nation: arousing strength from the people, inspiring wisdom within the people and refreshing the minds of the people (Yan 1895: 14, 27). He further advocated the necessity of both drawing on the scientific knowledge of the western world and importing their advanced cultures of humanities and of systems, both social and political ones (Ibid: 15). Thereafter, the beliefs of "saving the nation through science" and "saving the nation through education" became the consensus of the Chinese elite intellectuals, such as Kang Youwei, Liang Qichao and Yan Fu, who claimed that the road to strengthen the country existed in education. This idea was to be taken as dogma by many magazines originated and published during the years to come (Zhang et al 1986: 694).

In order to achieve the aim of saving China by science and education, the "1902 Education System" of the Chinese Qing government was revised in 1903 by Zhang Baixi, the educational minister, among others. Many subjects in science were introduced in Chinese schools at various levels, the only exceptions being nurseries and kindergartens (Li 1997: 481-482). Nevertheless, one of the necessary conditions for the realisation of education on science then was the abolition of the Imperial Examination System. It was finally abolished in 1905 after its continuance for some one thousand years. This subsequently triggered modern science education in the new-style schools at the beginning of the 20th century. Statistics show that, during the years between 1907 and 1909, the number of primary schools approached 210,000 with the total number of pupils nearing 2.5 million, and high schools reached 1319 with 110,000 students.2 This scale was unprecedented in establishing schools to promote the education of science and transmit scientific knowledge to a younger generation, which would be essential to the first cultivation of science culture on a large scale in modern China.

At that time, two pressing problems associated with the new education involved the training of teachers and the preparation of textbooks. Subsequently, proposals for sending students to study abroad, and extensive translation of books on western knowledge, flourished. Due to the influence of various factors such as political and economic ones, most Chinese students going to study abroad went to Japan instead of Europe or the USA (Chen et al 1991: 686-688; Li 1997: 736). In spite of its limitations, a large number of Chinese students went to study in Japan and teachers as well as translators were trained within a short span of time. There is no denying the fact that the initiation of modern education naturally entailed the extensive translation of books on western knowledge because China otherwise did not have them. As some contemporary intellectuals put it, "At present a new policy is being implemented and education being reformed. Consequently, although many things need to be done, the translation of textbooks is the priority." For "only the translation of a variety of textbooks is closely associated with the new-style education..." (Li 1996: 340-341). Sending Chinese students abroad was not only one part of absorbing western science culture, but prepared translators for translating western books on various subjects. Therefore, the establishment of new schools, sending students to study abroad and translating western books was closely associated with each other—studying abroad to train teachers for modern education, which in turn served to enlighten the Chinese people, and translating books that formed one of the necessary preconditions for the other aspects. It naturally followed that "the beginning of political reform resides in the prosperity of schooling and the key of the latter lies in translating books", and "translating books in particular forms the base of education" (Ibid: 94). Furthermore, various textbooks had to be translated—"Since schools now must teach western politics and western science, it is natural that textbooks of this type should be translated to satisfy the need to study western books" (Qu et al 1991: 25-31).

3. Large-scale translation of scientific textbooks

Under the policy and doctrine of "saving the nation by science" and "saving the nation by education", translation activities in China entered a new era and reached another climax. Because some materials are not accessible and a long time has passed since the publication of some translated books, it is impossible to examine each translated book in detail in this paper. In addition, this research focuses on the cultural functions of such translation in the recipient culture. This being the case, the following elaboration will be developed around a general survey, statistical analyses, a comparative study, a description of criticism and social functions.

3.1 A general survey of the translation of scientific textbooks

The translation of scientific textbooks in modern China can be roughly divided into two phases up to the year 1894.The first stage, lasting from 1840 to 1894, is characterised by passiveness, small number and narrow scope of use. Many translated scientific textbooks were originally scientific books and were only used in a couple of very small higher education institutions. The original works were mainly selected from European and American countries and the translators were mostly western missionaries with the participation of a small number of Chinese scholar-bureaucrats.

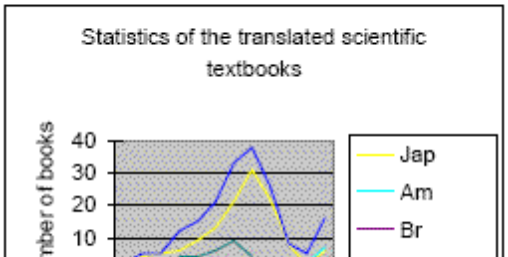
The second stage of scientific textbook translation extends from 1894 to 1919, the latter time point indicating a new era in the history of China. Towards the end of the 19th century and the beginning of the 20th century, a new surge of translated books was promoted by the emergence of a new-style of schooling. Translation activity was then stimulated and a large number of books were translated, which exerted an extensive influence. The original works were mostly selected from Japan and translation work was carried out largely by Chinese students still studying there or who had already come home, and also by some voluntary public organisations. Scientific textbooks were translated mostly to meet the need of the newly-established schools. After this initial period, the translation of western scientific textbooks entered a new stage. They were unequalled in number and were accepted with enthusiasm though their quality was, and is, believed to be far inferior to that of translated books in the earlier era due to various historical factors (Wang 1996: 12). In addition, attention was paid to some extent to the unification of translated terms in Chinese in translated scientific textbooks.

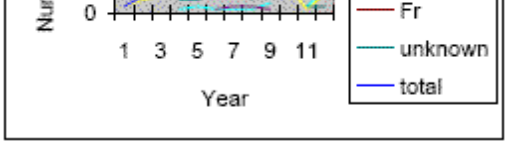
In order to provide an accurate description of the translated scientific textbooks of this period, statistics have been collected on the basis of available material sources. The latter include : *Textbooks for Primary and Secondary Schools* and the appendix *Textbooks for Primary and Secondary Schools of the Late Qing Dynasty* in *The General Bibliotheca of the Republic of China* (1911-1949); the fascicule of "natural science" in this bibliotheca also includes some scientific textbooks translated during the years from 1900 to 1911, twenty- three of which can be confirmed as textbooks and are therefore included in the statistics; *The Comprehensive Bibliotheca of China's Translated Books from Japan* also lists some translated books, thirty-six of which are scientific textbooks, including those marked by "before 1911" while excluding the science books in an encyclopaedia translated at that time from Japanese. There are five translated books in the first source whose publication years are unknown and are therefore not counted in the final results (Beijing Library et al 1993: 262, 271, 337, 341, 350).

Fig 1 Statistics showing numbers of translated scientific textbooks for primary and secondary schools during the period 1900-1911

Year / Country	1900	01	02	03	04	05	06	07	08	09	10	11	total	%
Jap	2	4	5	6	9	13	21	31	22	8	1	6	128	68.8
Am				1	2	1	1	1	3		2	7	18	9.7
Br						1	2	2	1			1	7	3.8
Fr				1									1	0.5
?		1		4	4	6	9	4			2	2	32	17.2
total	2	5	5	12	15	21	33	38	26	8	5	16	186	
%	1	2.7	2.7	6.5	8.1	11.3	17.7	20.4	14	4.3	2.7	8.6		100

? stands for "adaptation" and "unknown".





Overall, these statistics reflect the profusion of scientific translation. They also give us important information regarding two points.

First, most of the scientific textbooks were translated from Japanese at the start of the 20th century, amounting to 68.8% of the total books translated; there must be some more among the 32 books classified as 'adaptation' and 'unknown' which were also translated from Japanese. In contrast, books translated from other countries add up to much smaller numbers. It has been correctly pointed out that "nearly all textbooks of natural science are translated from Japanese" (Tan 1980: 62). This selection orientation concretely materialises the ideological principle of learning from Japan and translating Japanese books to import western knowledge indirectly.

Second, there are still some books classified as 'edited' in the general bibliotheca which are actually translated in a flexible way. The two books published by The Commercial Press in 1903 were both "adapted from Japanese books on mineralogy" (Sanetou 1983: 283). Third, translations of scientific textbooks from Japanese were all undertaken by students studying in Japan or persons who learned Japanese in China. This indicates that home-made translators had become independent practitioners of translation in the new era, in striking contrast to the translation activity in the previous stage.

It is clear from Figure 1 that the climax of scientific textbook translation occurred during the years between 1903 and 1908, with 145 books translated in 6 years and accounting for 80% of the total. It is this period that witnessed the abolition of the Imperial Examination System and the large-scale implementation of the new-style education, which reflected the underlying purposes and social functions of science translation at that time. Translation in this direction declined from 1909 onwards. This can be explained by the following factors.

(1) The statistics are based on a bibliotheca including the books in three major libraries in China and some translated textbooks may have got lost. But the tendencies in the statistics still reflect the essential characteristics of scientific textbook translation at this stage.

(2) The 1902 Education System was not put into effect and it was the system established in 1903 that was officially enforced, with the result that schools at various levels began to require translation of scientific textbooks, which further mirrors the influence and constraints of socio-historical background over translation activity and its definite purposes.

(3) The momentum of initiating new schooling had been going on since 1894, but it was not until the complete abolition of the Imperial Examination System that the education system of science culture in modern China was finally established and the need for scientific textbooks accordingly proliferated.

(4) The declining number of translated scientific textbooks in 1909 shows that the ability of Chinese authors to edit textbooks independently had improved and that their number increased. Du Yaquan, one of the best-known science translators at that time, pointed out in the preface of a translated scientific textbook that "textbooks can never adapt to the teaching work in this country unless they are compiled with new ideas" (Du 1905: i).3

Moreover, the number of publishing houses which published these translated textbooks amounted to 60. This indicates that the enterprise of publishing gradually flourished in education and translation. Furthermore, the total number of translated scientific textbooks reaches an average annual number of 24 books translated during the six years of the translation climax. This number was large even in comparison with those translated during the Republic of China.

Fig 2 Statistics for Translated Scientific textbooks for Primary and Secondary Schools during the Republic of China

	Jap	Am	others	?	total	%
1912-1918	39	10	6	12	67	38.7
1919-1936	4	30		29	63	36.4
1937-1949	2	26		15	43	24.9
total	45	66	6	56	173	
%	26	38.2	3.5	32.3		100

A comparison between Fig 1 and Fig 2 (with the same sources for statistics) indicates that the tide of scientific textbook translation sharply ebbed during the Republic of China with an average annual number of only 4 books; books translated from the Japanese reduced considerably and those from the USA rapidly increased. This indicates another shift of translation selection of the original works in the 20th century.

3.2 Detailed description of translated scientific textbooks

The direct purpose of scientific translation in the first half of the 20th century was to serve the teaching practice in the new-style schools at various levels. Translated books of this type stored in the Shanghai Library generally give such explanations in their prefaces. The "notes on the use of the book", appended to the translated *Lectures on Chemistry—A Book of Experiments*, say that "indeed few books on chemical experiments can be found in this country and this book has been translated to fill a void" (Kametaka 1902: i). It is worth noting that, at the beginning of developing education on new knowledge, some translators resorted to translation to expound the principle of reading and academic study in order to urge students and inspire study. Du Yaquan, in the preface to a translated book, gave a detailed explanation of this topic:

There are branches of study specific to one country and there are general branches common to the world ... Among the latter, however, there are also specific branches ... Physics and chemistry may focus on the artifacts and products of one's own country, using its own materials to support them and its own language to record them ... Chemistry books in our country have been translated for 30 to 40 years. Today, however, there is only general chemistry but there is no chemistry of our own. No proper samples for a term can be found to explain essential notions; for a theory, no words can be used to clearly express its details and subtleties ... In my opinion, scholars have two responsibilities in order to absorb the general chemistry and establish one of our own: one is to import and the other is to refine. The former means to seek new knowledge from other countries as a basis of materials; the latter means to verify the new theories and methodologies from other countries. They are to be taught and popularised among our people and be substantiated with materials collected from China so as to make new findings in a branch and make contributions to the world. Then this branch will be one of our own (Du 1905: 1-2).

Needless to say, discussion of this type is still enlightening for academic studies today.

The translator of *Chemistry*, after making a comment in the Preface on the demerits of translation in previous times, entrusted great expectations from Chinese readers. The translator thought that, though modern knowledge of chemistry had spread in China for over 30 years and a few books had been translated,

... scholars in former times clung to ancient laws and disdain truth. Only a couple of intellectuals with prevision explored deeply, collecting strange ideas for study by themselves with a result of vague effect in spite of their knowledge of an outline...The Authorized Education Statute prescribes that chemistry be taught in all schools above the secondary level. I believe there must be students with excellent talents from now on who will pool their efforts to make extensive study in chemistry (Still 1903: i).

The Statute was issued and implemented in 1903 and the translated book was published in September of the same year. It serves to show that the translator cherished great hopes about western-style education in the newly-established schools. Translations in previous times exerted influence within a narrow scope, while new education was carried out on a large-scale in these new schools. As Xiong Yuezhi, one Chinese scholar, put it in one of his works cited in this paper,

western knowledge imported by the way of Japan at the beginning of the 20th century is of the greatest amount and of the widest influence (Xiong 1994: 6).

Various new textbooks, which enter into thousands upon thousands of families and which a vast number of students read day and night, exert a social influence which greatly surpasses that by the famous works translated by Yan Fu, the great translator at that time (Ibid: 6-7).

In comparison with the books translated directly from western countries by organisations and publishing houses, the books on western knowledge translated from Japanese "exerted greater influence both in width and in depth" (*Ibid*: 7).

It is generally believed that science texts are uniform in meaning and the surface structure tends to be in harmony with the deep structure. Words used in them are expected to be precise in their explanations, avoiding ambiguity or polysemy. Nevertheless, this does not mean that there is a one-to-one correspondence between words and meanings. Therefore, translators at that time also adopted the translation method of flexible treatment:

Where there are considerable difficulties in transference, minor changes have been introduced. The main ideas of the original are preserved while shifts and additions are occasionally employed (Du 1905: i).

The original meanings which sometimes do not agree with those of Chinese have been shifted slightly after careful consideration and all the rest remain the same (Still 1903: i).

Thus translation of any type of text must resort to the combination of literal and liberal translation methods as a result of linguistic differences, only with a variation of degrees.

Translated terms have always been a crucial problem in science translation. Their study forms the basis of the discipline of terminology, which is

> ... concerned with the collection, description, processing, and presentation of terms, which are lexical items belonging to specialized fields of discourse. Terminologists are therefore among those in a position to investigate and to influence the development and use of specialized language. Numerous sets of guidelines have been proposed by terminology scholars...They commonly address issues such as monosemy (one-to-one relationships between terms and concepts), transparency, and conciseness" (Bowker 2001: 589-590).

Generally, translation methods for technical terms include (i) not translating the term; (ii) transliteration of the sounds into phonemes and then the graphs in language L2; (iii) the adoption of an existing term in L2; (iv) the formation of a new term combining two or more existing terms or characters in L2; and (v) the formation of a new character or the revival of an archaic one (Wright 2000: 204-209). It is suggested that Chinese translators in modern times tended to adopt such translation methods as employing existing characters and ready-made translated terms, translating meanings, transliteration and coining new words (Wen 2005: 87) In the actual translation of technical terms, as early as in the period of Foreign Affairs Movement, organisations such as the Translation House of Jiangnan Arsenal once made initial valuable efforts in this aspect. Led by John Fryer (1839-1928) and Xu Shou (1818-1884), it established three principles for translating technical terms: continuing to use ready-made translated terms, employing transliteration or coining new characters by adding radicals, and making Chinese-English vocabularies (Wang 1995: 15).4 The fundamental approach implied in its translation of chemical substances is based on the radical-phonetic principle with the only exceptions being the gases. Since this principle largely agrees with the modern tendency of coining Chinese characters by means of *xingshengzi*, viz. one part within the character indicating the sound and the other part indicating the meaning, the system of translating terms "used in all the Jiangnan Arsenal translations... eventually overcame all its rivals to be the basis of modern chemical terminology in Chinese" (Wright 2000: 339, 341). Meanwhile, of all the sixty-five chemical elements translated by Jiangnan Arsenal in *Huaxue jianyuan* (*Mirroring the origins of chemistry*), 36 have continued to be used up to today (Zeng 2005: 25). These facts further indicate the great contributions made by the Jiangnan Arsenal to the translation and unification of technical terms in modern China. After that, important supplementary effort was made by Du Yaquan, who followed the aforementioned principle to translate terms for gaseous substances, using the gas radical with a phonetic

component. This was again retained by the standardisers of the 20th century (Wright 2000: 349). In contrast, the Terminology Committee of the Education Association of China set up in 1890 tried in vain to standardise terminology in different ways (*Ibid*: 346-349).

At the beginning of the 20th century scholars such as Du Yaquan and Yu Heqin, and organisations such as the Translation House of the Capital University, the Translation Division set up in 1904 and the Book Translation and Editing Bureau of the new Ministry of Education also paid attention to the problem of the unification of translated science terms. For all their efforts, translated terms remained a big obstacle in scientific textbook translation for a long time, partly because "...other authors were busy inventing yet more variations in their own textbooks, picking and choosing from other systems as they saw fit" (Wright 2000: 345), and "none of the translators was willing to admit his own system was inferior to the others" (Ibid: 346). Translators then tended to add explanations for their own ways of treating terms, weights and measures in the prefaces to the translated books, especially those which had never been encountered in previous translations. Du Yaquan explained that

> translated works in former times have not touched any bit of the theory in this book. The translated terms cannot but move towards the Japanese original, adopting those which agree with Chinese and creating new Chinese terms on the basis of the theory when the originals do not agree with Chinese, which does not mean that the translator is fond of creation (Du 1905: i).
> In translating this book, terms for minerals and organic substances were treated with different methods for the purpose of unification. For translated terms, Ma Junwu chose to "continue to use the ready-made nouns from Chinese with the occasional adoption of Japanese terms", and there were also not a few "newly created ones" (Ma 1918: i).

David Wright insightfully points out that "the state of *translated* terminology is sensitive to the cultural milieu and the circumstances in which the translations are conducted" (Wright 2000: 327). He explains that "the process of term formation is an evolutionary process, not only in the sense of 'development', but as a process which has analogies with natural selection in the biosphere" (*Ibid*: 329), but "the length and outcome of these struggles is hard to predict. Synonymous terms arise, and may coexist for long periods" (*Ibid*: 333). At last, "something approaching the peaceful, bland, compromised ecosystem of a garden is established, in which only 'cultivated' terms, which no longer compete aggressively for semantic domains, are allowed to exist" (*Ibid*: 328).

As a matter of fact, various linguistic, cultural and historical factors contributed to the confusion of translated technical terms around 1900 in China. First, translators worked in mutual isolation at the very beginning and formed their own sets of terms which competed for survival. Second, the related department of the centralised government tried at times to control the "terminological wilderness" both for practiocal reasons and as a demonstration of its "national and linguistic sovereignty" (Wright 2000: 327-328). Third, the approaches adopted to translate technical terms violated the norms of the recipient language, as was the case with part of the practice of the Terminology Committee. In other words, lexical importation is constrained by "the cultural compatibility of foreign items" (Amelung et al 2001: 5). Fourth, the historical context had changed and "foreign influence on the course of chemical terminology in China was already on the wane" whereas the western missionaries were still too arrogant to show any regard for book publication and to "include a single Chinese person on their committee" (Wright 2000: 349). Fifth, readers' familiarity with existing translated terms was ignored (*Ibid*: 350). Sixth, the rapid development of chemistry in the 19th century produced a great number of chemical elements and inorganic and organic compounds and subsequently posed difficulties in establishing translated terms; by contrast, the number of terms needed in physics, astrnomy, botany and mathematics was relatively small and "it was almost always possible to coin new terms by employing existing characters" (*Ibid*: 222).5 Seventh, the swiftness and the extent of change of lexical and cultural borrowing around 1900 had no parallel in Chinese history and "the Chinese scientific and political lexicons were almost completely displaced by new terms" (Amelung et al 2001: 2).

Such being the case, translated terms in the scientific textbooks at the beginning of the 20th century remained rather chaotic despite all those efforts both by individuals and by organisations. "Much divergence has been existing among terms in chemistry", which left translators confused about what to choose. Terms of minerals in *Chemistry* "all follow the newly worked-out ones by School and Textbook Series Committee", and those for organic substances "have mostly adopted terms translated by Fryer" (Still 1903: i). Translation of weights and measures was even more

difficult. Since different translated books adopted different translated terms, this book "allows the original numbers to remain intact, sometimes with Chinese numbers listed to the left for reference" (*Ibid*). But most of the transliterations of weights and measures in the book are now abandoned. In addition, most of the terms in the translated book of *Botany* published in 1904 differ considerably from those now prevalent and some of the Chinese characters were even coined by the translator, which are hard to recognise and write (Wang 1993: 10). The translated terms in *Textbook of Chemistry* translated by Zeng Zonggong from the Translation House of Capital University also include some terms widely different from those prevalent ones, despite those still being adopted today (Yang 1986: 282-287). It follows that terms provided by the contemporary official authorities may still be abandoned in subsequent eras. Thus only after years or even decades of negotiation and debate were the definitions and systematic values finally settled in the new contexts and approached a uniform status (Amelung et al 2001: 1).

Naturally, the standardisation of technical terms after 1900 in China also benefited from the large number of words transmitted from Japan. That is because Japan had created new character combinations or neologisms in such fields as chemistry, botany and anatomy for the purpose of knowledge transmission (Montgomery 2000: 231):

Terms coined in Japanese typically followed the word-formation patterns of Chinese, thus allowing their smooth importation into Chinese contexts after the translation of Japanese texts was recognized as a short-cut to acquiring new knowledge (Amelung et al 2001: 5).

A statistical investigation shows that confusion in translated chemical terms had reigned before 1920 and after that technical terms were rather uniform (He 2005: 176). In 1932 when the Ministry of Education of the Republic of China published *Huaxue mingming yuanze* (The principles of naming chemical substances), years of discussion on the translation of chemical substances finally came to a temporary end.

Modern Chinese first appeared in newspapers, the first of which must be *Hangzhou Modern Chinese Newspaper* first published in 1895 by Lin Qinnan (or Lin Shu, 1852-1924). Lin was a major literary translator, equally famous as Yan Fu, who mainly translated Western works on social science. Lin translated over one hundred novels which exerted great influence over Chinese literature and writing in the late 19th and early 20th centuries. Statistics show that over one hundred and seventy newspapers in modern Chinese were published during 1897-1918, not including those partly adopting modern Chinese (Cai 1987: 493-546). However, few translated books at that time adopted modern Chinese.6 Though books translated then were of new knowledge, the translation language was not modernised. In reality, the title of "students studying abroad" in the late Qing Dynasty, especially towards the end of the 19th century, was by no means a shining one as it is today. On the contrary, in the eyes of the scholar-bureaucrats, it was a title associated with such evil names as idlers, persons blindly worshiping foreign things, and those with low standards of morality and having neither learning nor skills. The lines "Learning foreign languages by mistake / The whole world decided to forsake" (Yan 1986: 586) by Yan Fu vividly reflect his depression resulting from the cold treatment by the scholar-bureaucrats for his learning foreign languages. Zhang Taiyan, a well-known traditional scholar, used as pretexts Yan Fu's studying in the west, adoring the western countries and laying a superficial foundation of Chinese learning, to ridicule him for his translation of *History of Politics* (1904). So Yan Fu formally acknowledged as his teacher the master of Tongcheng Prose School with the deliberate purpose of studying classical Chinese literature and he even "hesitated for ten days to one month for the translation of a term" (Yan 1986: 1322), which not merely represents his strict attitude in his study, but embodies his effort to demonstrate his good foundation of traditional learning of classical Chinese (Xiong 1994: 699). He claimed that his translations were for those who were familiar with classical Chinese books, which also reflects his psychological betrayal of his wish to build up a new image of students studying abroad among traditional Chinese scholar-bureaucrats (Ibid). Therefore, probably for similar reasons, those students coming back from studying abroad also translated scientific textbooks using classical Chinese, and the punctuation in translations were also of the old style, though language norms must also have worked in this process of language choice. As late as in the last years of Qing Dynasty and even in the Republic of China (1911-1949), classical Chinese was still used in translating scientific textbooks as well as other science books (Ueno 1909; Ma 1918). In fact, many scientific translations in the later half of the Republic of China, viz., during 1930s and 1940s, still were produced in classical Chinese even though the Government issued a mandate in 1920 that schools at various levels partly adopt textbooks in modern Chinese from the autumn of that year, and that textbooks in classical

Chinese be abolished from the winter of 1922. Examples are translations of such science masterpieces as *Philosophiae Naturalis Principia Mathematica* by Isaac Newton and translated in 1931, *Science et Méthode* written by Henri Poincaré (1854-1912) and translated in 1933, *An Absolute Scale of Temperature* by William Thomson (1824-1907) and translated in 1937, and *Origin of Cultivated Plants* by Alphonse de Candolle (1806-1893) and translated in 1940, to name but a few to illustrate the use of classical Chinese in scientific translation at that time.

Statistics in the above show that, from the beginning of the 20th century to the period of the May the Fourth Movement (1919), the majority of translated scientific textbooks were from Japanese originals. Nevertheless, the high number of Japanese books to be translated inevitably resulted in the poor quality of some translations. This led to more severe criticism than praise of the translated textbooks by the contemporaries. Fu Sinian offered unusual affirmation (Fu 1919), and Tan Ruqian, in his high praise of the quality of the translated scientific textbooks, said, "the translations of natural science are generally of high quality; they are mostly clear and offer good readability in addition to fine illustrations." Yet "translations at that time were often incorrect, and wanton, stiff translations and even mistranslations were very common" (Tan 1980: 62). Some magazines published at that time, such as *China's Education* (Yang 1994: 143-150) *China Daily and Foreign Countries* (Li 1996: 349-351) and *Shanghai Daily*, (Li et al 1995: 199) all published articles strongly criticising the quality of translations. In criticising the demerits and the poor quality of translations, Zhou Guisheng said,

It is rare to observe at once the three principles of faithfulness, smoothness and elegance in translating books. These days the so-called translators in the main are only capable of picking up a pen and translating literally. Otherwise they choose to copy and even plagiarise with pages full of perfunctory treatments. Translations from Japanese are characterised by new terms; translations from western languages are unavoidably filled with difficult words and awkward structures" (Zhang 1957: 58).

There were, of course, also those who suggested the improvement of translation strategies, strengthening criticism of translated books or other measures in order to improve the quality of translated books.

There were different reasons for the criticism and the praise of the translated scientific textbooks in the early 1900s. If, however, comments were made with reference to the socio-historical context instead of haggling over the details of the use of words, evaluation of these translations would be quite different and more realistic. With the surging of new education and the unusual speed of translation to meet its need, it is justifiable that some translations were of poor quality and their criticisms were not unexpected. But the translation of scientific textbooks, driven by social needs, exerted an influence which cannot be underestimated. As far as the situation at the time is concerned, only by translating a great number of textbooks could the newly established school education be implemented and scientific knowledge from the west be spread swiftly on a large scale among Chinese people. Only by doing so could new cultural elements be infused into traditional Chinese culture, which led to its changes and evolution and further to the realisation of the original purpose of scientific translation, also the ultimate aim of scientific translation in this period—saving the nation and making the country strong.

4. Social functions of translated scientific textbooks

In the 20th century, China developed new attitudes to scientific culture and the popularisation of scientific knowledge in the whole country became visible. Scientific translation at the beginning of this century helped to lay a good foundation to this development. It is safe to affirm that the translation of scientific textbooks for primary and secondary schools at that time served to construct an extensive basis for Chinese culture to move forward to modernisation. Its cultural functions can be examined from four perspectives: enriching the Chinese language, understanding the concept of 'science', popularising scientific knowledge and transforming social visions.

4.1 Enrichment of Chinese vocabulary and change in writing style

Language serves as the medium of knowledge transmission and is also an important part of culture. Each level of language may contain cultural information and culture forms the basis of language. In the opinion of Sapir,

"Language has a setting... Again, language does not exist apart from culture, that is, from the socially inherited assemblage of practices and beliefs that determines the texture of our lives" (Sapir 2000: 186). Of all the layers of language, the one most susceptible to influence and changes is vocabulary. Thus linguistic change, driven by the need to transfer knowledge through translation, is a major "gain" (Montgomery 2000: 272). Modern scientific translation imported a large number of words into Chinese, especially at the beginning of the 20th century. Xiong Yuezhi suggests that "the biggest influence on Chinese vocabulary is the translation of Japanese books into Chinese and the largest number of words were introduced during the late Qing Dynasty" (Xiong 1994: 674). Here "the late Qing Dynasty" primarily refers to the beginning of the 20th century because translated Japanese books before that time amount to only a very small number" (Tan 1980: 352).

During the first climax of western knowledge flowing eastward in the late Ming Dynasty and the early Qing Dynasty, Ricci Matthieu (1552-1610), the Italian missionary, and Xu Guangqi (1562-1633) introduced or created some new words in their scientific translations, very few of which are used today. At the beginning of the 20th century, the number of western books translated from Japanese increased rapidly and a large quantity of words entered Chinese. For Chinese and Japanese are of similar culture and words in both languages sometimes carry similar meanings. Therefore Chinese students studying abroad and domestic translators encountered little difficulty in understanding Japanese texts. Furthermore, many words in Japanese could be directly borrowed when translating science books in Japanese language into Chinese. Thus, "new books translated from Japanese poured into Chinese like wild billows and new words translated from Japanese penetrated like mercury pouring on the ground" (Xiong 1994: 673).

The book of *A Study on the Loanwords in Modern Chinese* includes a part on "foreign things and concepts expressed by loanwords in modern Chinese". It classifies all loanwords into 29 groups, each of which is further divided according to the source countries. All the loanwords add up to 1270, 459 being from Japanese and 547 from English. But only 84 words from languages other than Japanese are familiar to Chinese readers while most of those from Japanese seem familiar words which are extensively used with high frequencies. Words from sciences belong to 15 branches, amounting to 82 Japanese words (Sanetou 1983: 321-325).

But this statistical result arouses much suspicion. According to *Western Knowledge Flowing Eastward and the Late Qing Dynasty*, *An Anthology of Papers on the History of Cultural Communications between China and Japan* and *The History of Chinese People Studying in Japan*, only science words translated from Japanese add up to over 250, and most of them were imported into science translation from Japanese at the beginning of the 20th century. As stated in the preface to *A New Dictionary of the General Disciplines* published in 1911, "more than half of the new words in our country were imported by way of Japan" (Sanetou 1983: 292). In the paper "A comment on the field of writing and translation", Ruo Xu said:

Chinese have always been despising Japan, including its academics. Some speculative translators tried to find Japanese translations of foreign originals and translate them in a confusing way into Chinese while they boasted in ads or on book covers that these books were translated directly from western languages; ... A glance at them indicates that eight or nine out of ten are from Japan (*Ibid*. 292-293).

In the *Dictionary of New Knowledge* published in 1958, in which science terms are included, over half of the words are Japanese ones or words with combining ingredients from Japanese (Ibid: 311). Wang Li, an outstanding Chinese linguist, believes that "most of the liberally translated words in modern Chinese are adoptions from the original translations by Japanese rather than original translations by Chinese of their own" (Wang 1990: 695). In addition, many transliterated words in modern Chinese also have roots in Japan because Japanese translators adopted Chinese characters at first to transliterate western words, e.g. *wasi* (gas), *hunningtu* (cement), etc (Xiong 1994: 305). Gao Mingkai, another distinguished modern Chinese linguist, also points out that modern Chinese loanwords mostly come from Japanese, and "Japanese vocabulary has exerted a considerable influence on modern Chinese; it forms one of the major sources of the loanwords in modern Chinese and can even be taken as the biggest source; many words from European and American languages have entered Chinese by way of the Japanese language" (Gao et al 1958: 158).

It is now hard to compile a precise figure about the number of words translated from Japanese

into Chinese. Nonetheless, historical materials show that new words from Japanese have influenced almost every aspect of the Chinese language, both in written and oral forms, in such fields as literature, history, philosophy, economy, law, art, mathematics, physics, chemistry, astronomy, geography, biology, medicine and agriculture. One scholar even asserts that words translated from Japanese books are mostly scientific or technological and their influences are rather extensive:

The words that were borrowed from Japanese in modern Chinese are for the most part specialised terms of science and technology, and include some common words. These words are very frequently used in the Chinese written language in books, magazines and newspapers today. Consulting reference books such as *A Dictionary of New Words* and *A Dictionary of New Knowledge* leaves an impression on readers that nearly half of the words listed are borrowed from Japanese (Wang 1982: 460).

The influence of words and terms from translated Japanese books on the Chinese language and culture is far-ranging, the extent of which can be demonstrated with the frequencies of use of around 250 science words used previously in modern Chinese texts. Though the old-style scholars in the late Qing Dynasty and the early Republic of China often frowned at the new words, intellectuals of the new generation showed great interest in them. After 1911, new words and terms flooded the Chinese language:

Even pupils had them on their lips, being unwilling to fall behind others. Publishers vied with each other to publish books with new words to cater for readers as well as their wallets... People volubly used these words in a mechanical way as if they were inherited from their ancestors (Sanetou 1983: 305).

It is recorded in the book *New Words of the Blind Leading the Blind* that "new words from Japanese began to be introduced into China after the defeat of the 1894 war. Now Chinese people mechanically employ them, using them everywhere, with at least six out of ten being new words even in private letters" (Xiong 1994: 305).

At the beginning of the 1900s, many words poured into China and intellectuals picked them up at random in their writing and speech, gradually gaining familiarity with them. As a consequence, polysyllabic words in the Chinese language increased a great deal. Their introduction echoed the modern tendency of Chinese to become a language with polysyllabic words and they were therefore accepted as fixed words. Wang Guowei, a modern Chinese scholar and writer, suggested that

The Japanese language has more double-character words and constructs four-character words when necessary, while the Chinese language used to adopt one-character words, where exists the distinction between the extents of precision of expressing ideas (Wang 1994: 305).

In fact, the original words in Chinese were mainly characterised by single characters. Wang Li also pointed out that

The Chinese language had its original double-character words and had more in early modern times; but there were less in classical literature than in Europeanised texts in modern times. A proportion of them in ancient times, early modern times and modern times is one to three to nine (Wang 1985: 300).

It is because of the influence of translated Japanese books that Chinese language experienced a gradual transition from single-character domination to a language with words of more than one character. Out of the fifty-three words in science and technology and medicine listed by Xiong Yuezhi, forty-four are double-character ones, accounting for over 83%; one hundred and twenty-two words out of the aforementioned two hundred and fifty words are of double characters, accounting for some 49%. That the Chinese language changes from single-character to a high degree of words of more than one character represents the biggest influence of new words imported from translation, which not merely makes the Chinese language capable of expressing new things, but makes Chinese more lucid, meticulous and precise and more capable of expressing complex ideas and subtle meanings. Sanetou thinks that

China gained maximal convenience in taking modern culture due to this excellent weapon. In the

whole process of modernisation by way of Japanese books was produced modern Chinese fitness for absorbing modern culture (Sanetou 1983: 337).

Wang Lida also pointed out that

> Modern Chinese actually contains many words borrowed from Japanese. The input and prevalence of these words not only enrich the vocabulary of Chinese, but bring to us great convenience in receiving modern science and technology from the west (Wang 1958: 94).

The translated terms by Yan Fu did not last for long partly because he inherited the Chinese traditional characteristic of single-character words and was fond of adopting single characters to translate concepts from western science.

With the enrichment of the Chinese vocabulary, its style also changed accordingly. In addition to the employment of Japanese words in his writing, Liang Qichao introduced the Japanese style, "both extremely energetic and novel", which was called "the style of Liang" or "the new style" (Sanetou 1983: 291). In his preface to *The Record of the Translated Books I Saw* (1927), Chu Zongyuan also reported that "...in 1894 our country fought with Japan and peace was made the next year. Students studying abroad all chose to go to that country and translation of its language is easier than that of other languages. Consequently, translated books of Japanese filled the book market and were supplied to schools, which made academic studies fashionable and the writing style in our country changed a little bit" (Zhang 1957: 95). With regard to the changing style of Chinese, Wang Li once made the comment that "it is sometimes necessary indeed to write long sentences to express modern ideas and produce logical texts...Europeanisation in grammar cannot but be adopted" (Wang 1971: 336).

In the late Qing Dynasty and the early Republic of China, especially the first decade of the 20th century, science words from translated science books—new words directly coming from Japanese or borrowed by way of Japanese—and the change of writing style in Chinese in this process enabled the Chinese language to be more compatible with the absorption of modern science culture from the west. Furthermore, these science words carried with them rich information of a science culture and thus laid a solid foundation for it to evolve in China. Language evolution reflects the cultural changes in this respect. Therefore, if one of the standards for examining the evolution of Chinese culture under the influence of foreign elements is the extent of the acceptance and fusion of imported words, the enrichment of the Chinese vocabulary and the changes to its structure indicate the underlying evolution of Chinese culture. All this is based to a great extent on science translation at the beginning of the 20th century. It has been insightfully pointed out that

> ... the increase of Chinese words with more than one character, the development of ways of expressing ideas and the rise of modern Chinese without exception bear a close relationship with the introduction of new words from Japanese. Therefore we may assert with no exaggeration that the influx of new words from Japanese in the late Qing Dynasty represents a cultural transmission which has a far-ranging influence and extremely rich connotation" (Xiong 1994: 678).

4.2. Transition from science *to gezhi* and *kexue*

As has been discussed above, each layer of language contains rich cultural information of the culture system it belongs to. Words in a language carry with them condensed values, concepts and cultural accumulations corresponding to that language (Chang 1995: 1-3). Scientific translation imported scientific words and terms from the west, which further brought with them the message of western science to China. The emergence of the concept of *kexue (science)* between 1900 and 1911 reflects how cultural changes are expressed through the changing Chinese vocabulary.

Modern natural sciences in the west have three methodological supports for their formation—experimentation, logic and mathematics, all of which were not developed in modern China. Ancient China once developed splendid achievements in technology, but lagged behind the world in modern times in science and technology, which is termed the well-known "Needham Puzzle". It is known that the Confucian classics dominated social culture for a long time and science and technology were regarded as the most trivial arts, merely "fanciful tricks and evil skills" and "something of sub-

organic nature" (Duan 2001: 314). Studies and education "wandered among the six classics and paid attention to benevolence and righteousness" seldom involving the research and teaching of the knowledge of natural sciences (*Ibid*). A. Einstein thus explained the reasons why modern sciences did not rise in China:

The development of Western science is based on two great achievements: the invention of the formal logical system (in Euclidean geometry) by the Greek philosophers and the discovery of the possibility of finding out causal relationships by systematic experiment (during the Renaissance). In my opinion one should not be astonished that the Chinese sages have not taken those steps. The astonishing thing is that those discoveries were made at all (Einstein 1963: 142).

These remarks reveal the differences between science culture and Chinese traditional culture. For this reason, there was no equivalent word in Chinese to correspond to the concept of "science" in the knowledge system of western modern science. Thus in translating and introducing science in modern times to China, scholars fully exposed to the nurture of Confucianism could not but resort to the language of Confucian classics and adopt the term "*gezhi*" which is far from "science" in its connotations.

"*Gezhi*" is the short form of "*gewu zhizhi*", which is rooted in one of the Confucian classics *Book of Rites*, and its connotation actually implies that human morality and cultivation must be based on knowledge which comes from introspective speculations. Scholars of the Confucian school of idealist philosophy of the Song and Ming dynasties explained "*gezhi*" by emphasizing the sudden understanding through human intuition of the heart, which neither refers to the research of the material world nor implies the scientific methodology. It may be therefore called "*gezhi* of Confucian classics". The interpretation of "*gezhi*" by Zhu Xi (1130-1200), the most outstanding representative of Confucianism in the Song Dynasty, still falls into the category of ethics. Translating "science" into "*gezhi*" was to bring the former into the systematic framework of Confucianism. Nonetheless, during an era when the conservative scholar-bureaucrats posed obstacles to the transmission of western knowledge with the excuse of "China's defense against the west", this type of cultural misreading serves to set up a conceptual bridge for the introduction of western knowledge. In the late Ming Dynasty and Qing Dynasty, the thought of real learning for practical applications was introduced into the concept of "*gezhi*", which may be called "practical *gezhi*". It was more extensively used in the late Qing Dynasty. Later on, in order to distinguish between western science and Chinese traditional "*gezhi*", some scholars such as Yan Fu chose to use the concept of "*gezhi* of western learning" (Fan 1988: 40).

With the vicissitude of times, the connotations of "*gezhi*" gradually required something compatible to some extent with the concept of "science". Nevertheless, it remains a category within the theoretical framework of Confucianism and the substitution of "*gezhi*" for "science" inevitably resulted in cultural misreading owing to cultural differences, i.e. interpreting foreign cultural phenomena within the context of the recipient culture. It may be just because of the influence of misreading that Chinese people's understanding of the concept of "science" in later times could not break away from the restrictions of Chinese traditional culture.

Up to the beginning of the 20th century, scientific translation was the main instrument of dissemination of an accurate meaning of "science", among some scholars. Then the concept of "*kexue*" for "science" was more frequently used in China and the phenomenon of the coexistence of both "*gezhi*" and "*kexue*" appeared, which embodies the characteristics of language and culture during a period of transition in the process of the mingling of two cultures. Through the influence of translated texts, the concept of "*kexue*" inevitably superseded that of "*gezhi*", on the decline.

It seems that there is only a distinction between the two words in the transition from "*gezhi*" to "*kexue*", but the contents of the concepts differ strikingly from each other. The cultural background of "*gezhi*" is that of Chinese traditional Confucianism; it played a mediating role in the course of translating and introducing western science culture and served as a temporary channel for the transformation of the ideas of Chinese people and for the transition from Confucian culture to its combination with science culture. It is safe to conclude that the transition from "*gezhi*" to "*kexue*" vividly reflects the gradual evolution of Chinese culture under the influence of scientific translation activities. Naturally it is a historical necessity in the development of science culture that the former be replaced by the latter.

Science includes scientific knowledge, scientific spirit and scientific ways of thinking and science education refers to the teaching of the first and the cultivation of the other two. Traditional Chinese education material in primary and secondary school consisted of textbooks such as "*Three Character Primer*", "*Various Families' Surnames*" and "*The Primer of Poems*", and never included natural sciences textbooks. Before 1911, the first scholar who advocated science education was Yan Fu, the enlightened thinker (Yan 1986: 1-15). Large-scale science education in modern China dates back to the early 1900s, which was closely related to the translation of western scientific textbooks. As one researcher, has noted:

The introduction of western textbooks affirmed their legitimate position in the schools of China and considerably promoted the transmission of modern sciences from the west, which is of significance to the change of the direction of China's traditional education and advances the progress of modern China" (Wang 1996: 82).

Though scientific textbooks were already translated at the end of the 19th century, it was the beginning of the new century, especially the period after the abolition of the Imperial Examination System in 1905 that witnessed the influx of textbooks of this type. Furthermore, they were used extensively in the new-style schools at various levels, which is in striking contrast to the previous age when there were only a very small number of schools and students. Research also shows that "as a result of believing in Japanese education, teaching in the newly-established schools in the late Qing Dynasty exclusively imitated that from Japan, even to the extent of slavish imitation and loss of its own individuality. Eight or nine of ten of the textbooks adopted in these schools were translated from the Japanese" (Ibid: 79).

According to *A General Survey of the Publication of Textbooks* (1868-1918),

> Formal textbooks came forth in succession after 1905 ... there were those which were translated literally from Japanese textbooks... Before the founding of The Commercial Press, The Civilization Press published the largest number of them and other publishing houses followed. After 1903, most textbooks used by various schools were produced by The Commercial Press" (Sanetou 1983: 233).

In 1903, the Capital University issued "a provisional list of books for use in various schools" listing ninety-one textbooks. Over two-thirds of these were translated, except the textbooks for writing, the study of Confucian classics, rhetoric and moral cultivation which were written by domestic scholars. Only five textbooks out of those for twelve subjects were written by Chinese scholars, and textbooks for such subjects as Chinese and foreign geographies were all translated from Japanese books. This situation lasted until the end of the Qing Dynasty in 1911. When recollecting his life in secondary school, Guo Moruo, a master of modern Chinese literature, recalled:

> "In order to learn from Japan, China sent large numbers of students to study there and invited many Japanese teachers to work in China. At that time we also translated large quantities of textbooks originally used in secondary schools in Japan. Before I came to Japan, the textbook for geometry I used in the school at home was compiled by Kikuchi Dairoku (1855-1917), a Japanese mathematician at that time. In addition, physics textbook mostly chose the one edited by Honda Kotaro (1870-1954), a Japanese physicist in the era of Meiji" (*Ibid*).

When recalling his editing primary school textbooks, Jiang Weiqiao said, "at first publishing houses vied to publish translated Japanese textbooks, which had a ready market because Chinese people were fond of them after having suffered from the famine of knowledge for a long time" (Ye 1995: 17).

It is obvious from the above discussion that translation of scientific textbooks provided necessary preconditions for science education. Without translation and adaptation, there would not have been the editing and compiling of scientific textbooks in later periods, let alone the prospering of science education. A researcher even thinks that scientific translation played the role of making a stormy sea stormier in the course of the abolition of the Imperial Examination System and in the rise of science education (Li, 1993: 251). Needless to say, the idea of science education in its strict sense was imported from the USA after the founding of the Republic of China in 1911. In 1915, Ren Hongjun, a scientist and one of the editors of the influential journal of science at that time, wrote articles to discuss the relationship between science and education, claiming the application of

scientific methodology to education. In his discussion, "science education" appeared for the first time as a phrase in Chinese. He thinks that "education cannot be separated from science in any aspect" (Ren 1934: 107), and that "the importance of science in relation to education does not lie in the aspect of knowledge of materials, but in its research methodology of materials, especially in its cultivation of wisdom" (*Ibid*: 109). Sun Yat-sen (1866-1925) also emphasised that "science refers to systematic study. All real and specialised knowledge must come from science. Without science, most so-called knowledge is not real" (Sun 1985: 200).

Following those pioneering statements, writings and speeches advocating science education increased gradually, and, in combination with the banners of "equal attention to science and human rights" in the early New Cultural Movement (1915-1927), induced a great tide of science education, both as regards curriculum development and teaching methods. We may assert that translation of great quantities of scientific textbooks and the rise of science education at the beginning of the 20th century bear unprecedented historic significance to the evolution of Chinese culture. Translated scientific textbooks not only facilitated the distribution of scientific knowledge among a new generation of Chinese, but also played an irreplaceable role in the process of establishing the foundation of scientific spirit and scientific ways of thinking and the evolution of science culture in China.

4.4 Translation, knowledge and society. Conclusion

In the course of cultural transmission, the recipient culture is normally influenced first in its surface structure. With the accumulation of this influence, changes will take place in its deep structure when under attack by foreign cultural elements. As Montgomery put it, translation, the act "of rendering the words of one language into those of another, hopefully with little or no spillage of meaning" has been an important component in the transmission of knowledge (Montgomery 2000: 3). After the translation of western scientific textbooks and science education to spread scientific knowledge and enlighten Chinese people, their knowledge structure and cognitive schemata were enriched and even changed and scientific spirit and ways of thinking were cultivated.

Generally, discussions on the social influence of the transmission of western learning tend to focus on its influence on the intellectual elites while neglecting its subtle functions among the public. In discussing the social significance of the science translation at the beginning of the 20th century, researchers have been inclined to indulge in lengthy analyses of the famous works translated by Yan Fu, and brush aside the scientific knowledge imported from the West via Japan. The fact is that those translated scientific books, especially textbooks, exerted the greatest and most extensive impact on Chinese readers by penetrating into the hearts of large numbers of students and all those who came into contact with them.

As has been discussed in the above, most translated scientific textbooks were used in the newly-established schools to transmit scientific knowledge among them. In 1905, the *Southern Daily* said, "there are only translated books by public organisations which can be adopted since textbooks have not become mature and officially edited ones are mostly unfitting" (Li et al 1995: 199). In addition, many of these translated textbooks were republished time and again and some were even published for over 20 times, which proves their frequent use and extensive reaches of influence. Further, the translated science books were published and used again in the Republic of China, only with a change of cover and the addition of the phrase "Republican Textbook" on them with the contents remaining the same. Some formerly published scientific textbooks were republished or reprinted many times after the founding of the Republic. Many of them were published by The Commercial Press in Shanghai, the center of publication at that time.

Translated scientific textbooks differ greatly from the traditional textbooks at the time both in content and in cultural function., They acted as an important medium for the transmission of scientific knowledge and as new carriers of culture. As Xiong Yuezhi points out:

What really had far-reaching and large-scale influences are the new-style textbooks, which covered various subjects, included different levels, spread all over the cities and countryside, the coastal areas and inland areas, after the practice of 'New Deal' and the implementation of new educational system by the government of the Qing Dynasty at the beginning of the 20th century (Xiong 1994: 22).

With the increase of new knowledge among the Chinese public, the original knowledge structure of the whole society was unavoidably reshaped and enriched, which further remolded people's cognitive schemata. The knowledge structure of different times reflects people's understanding and knowledge of the universe and society. Changes in this structure and background are usually the source of changes in thought and idea of an era. As Ge Zhaoguang, a contemporary Chinese scholar, noted, "the accumulation of knowledge is normally the precondition for the acceptance of thoughts and the change of knowledge forebodes changes of thoughts" (Ge 1998: 134). Once the scientific knowledge, imported through scientific translation, entered into the cognitive structure of Chinese people, it interacted in many ways with their original structure, enriched their original knowledge structure and world schemata, and deepened or transformed their thought, thus modifying the cultural background of the whole society. Therefore, translation of scientific textbooks in China served to spread scientific knowledge; the accumulation of this knowledge modified people's knowledge structure; changes in this structure led to the changes in the deep structure of the thought of a nation. Culture changed accordingly. That is the logical deduction of the most important social function of scientific textbook translation at that time in China based on the evidence provided in the above.

Scientific translation can be approached from two perspectives: linguistic and cultural. Cultural investigations of the translation of scientific textbooks produced at the beginning of the 20th century in China show that translations were constrained by the historical context. Translation played a major role in the development of Chinese culture and translation criticism must be considered as instrumental in analyzing cultural factors in the development of a society.

Notes:

- Titles of these papers are as follows in a chronological order: Lun shi bian zhi ji (On the urgency of changing the status quo of China); Yuan qiang (Examining strength); Pi han (Refuting Han Yu); Yuan qiang xupian (A continuation of examining strength); and Jiuwang juelun (A decisive discussion on saving the country).
- The statistics, which does not include half-day primary schools and those in big cities, is based on Li Guilin et al (ed.). *A Collection of the Materials of the History of Modern Education in China—General Education*. Shanghai: Shanghai Education Press, 1995: 85-89.
- The translated scientific textbooks published from 1900 to 1911 usually had a one or two pages preface called "*Yili*"(rules of translation) to explain the rules which the translator abided by in translating the book while the body text started with new page number from 1 to the last. To avoid confusion, we use "i" to indicate the page number of citation though the original page number is of Arabic ones. In addition, all citations in this paper from Chinese sources were originally written in Chinese and are therefore all translations of my own.
- They are: Jinshi Zhong-Xi mingmubiao (*A Chinese-English vocabulary of mineralogical terms*, 1883), Huaxue cailiao Zhong-Xi mingmubiao (*A Chinese-English vocabulary of names of chemical substances*, 1885), Xiyao dacheng yaopin Zhong-Xi mingmubiao (*A Chinese-English vocabulary of names of Meteria Medica*, 1887), and Qiji Zhong-Xi Mingmubiao (*A Chinese-English vocabulary of terms relating to steam engine*, 1890), all of which were co-compiled by John Fryer and Xu Shou.
- According to Andrea Bréard, mathematics had a long history in China and possessed a sophisticated technical terminology, which was modified and extended within the traditional semiotic framework during the 19th century. New terms were created for the translation of mathematical texts, but most terms except operational symbols "flourished only for a transitional period before being superseded by Japanese loans" (Amelung et al 2001: 10). In the case of botanical terminology, things were similar. Métailié believes that "the modern botanical terminology, which was settled around 1920, has almost nothing in common with the nomenclatures created by foreign and Chinese translators in the period between 1858 and 1898" (Ibid: 11). For it was imported in large numbers from Japan where importation of botany had been started at the end of the 18th century and terminological standardisation had already been achieved (Métailié 2001).
- Early newspapers publishing translation in modern Chinese include *Suzhou Modern Chinese Newspaper* starting publication in 1901, *The World of Women* started in 1904, *Times* in 1904, and *Zhili Modern Chinese Newspaper* in 1905, all of which published translations on science and

literature in modern Chinese. Those who translated books using modern Chinese include Lu Xun, the famous writer, and Wu Guangjian, the outstanding translator who is believed to leave behind translated works of some one hundred million Chinese characters and exerted influence on modern readers until as late as in the May Fourth Movement.

- Translations from the Chinese in this article are the author's unless specified in the references.

References

- Bowker, Lynne (2001). Terminology and gender sensitivity: A corpus-based study of the LSP of infertility. *Language in Society*, 30, 4: 589-610.
- Beijing Library & People's Educational Publishing House (ed.) (1993). Minguo shiqi zongshumu (1911-1949): zhongxiaoxue jiaocai (*The General Bibliotheca of the Republic of China* (1911-1949): *Textbooks for Primary and Secondary Schools*). Beijing: Bibliography and Document Publishing House.
- Beijing Library & People's Educational Publishing House (ed.) (1995). Minguo shiqi zongshumu (1911-1949): zirankexue-yiyaoweisheng (*The General Bibliotheca of the Republic of China* (1911-1949): *Natural Science, and Medicine and Health Care*). Beijing: Bibliography and Document Publishing House.
- Cai, Sule (1987). Qingmo minchu de yibaiqishi yu zhong baihua baokan (Over 170 Modern Chinese newspapers published towards the end of Qing Dynasty and the beginning of the Republic of China). In Ding Shouhe (ed). Xinhaigeming shiqi qikan jieshao (V) (*An Introduction to the Magazines around the Revolution of 1911* (V)). Beijing: People's Publishing House, 493-546.
- Chang, Jingyu (1995). Hanyu cihui yu wenhua (*Chinese Words and Culture*). Beijing: Beijing University Press.
- Chen, Xuexun & Tian Zhengping (eds.) (1997). Zhongguo jindai jiaoyushi huibian: liuxue jiaoyu (*A Collection of the Materials of the History of Modern Education in China—Studying Abroad*). Shanghai: Shanghai Education Press.
- Du, Yaquan (1905). Huaxue xin jiaokeshu—yili (A preface to *New Chemistry Textbook*). Yoshidano, Henjiro. Shanghai: The Commercial Press.
- Duan, Zhiwen (2001). Zhongguo jindai kexuewenhua de xingqi (*The Rise of Science Culture in Modern China*). Shanghai: Shanghai People's Publishing House.
- Einstein, Albert (1963). Letter to J. S. Switzer, April 23, 1953. In A. C. Crombie (ed), *Scientific Change: Historical Studies in the Intellectual, Social, and Technical Conditions for Scientific Discovery and Technical Invention, from Antiquity to the Present*. London: Heinemann.
- Fan, Hongye (1988). "Kexue" gainian yu *Kexue* zazhi. (The concept of "*kexue*" and the *Journal of Science*). Ziran bianzhengfa tongxun (*Journal of Dialectics of Nature*), 3: 39-50.
- Fu, Sinian (1919). Yishu ganyan (Impressions on translation). *New Tides*, 1: 3.
- Gao, Huiqun & Wu Chuangun.(1992) Fanyijia Yan Fu zhuanlun. (*A Biography with Translator's comments—Yan Fu*). Shanghai: Shanghai Foreign Language Education Press.
- Ge, Zhaoguang(1993). Zhishishi yu sixiangshi (The history of knowledge and the history of thought). *Reading Books*, 2: 132-134.
- Gentzler, Edwin. (1993) *Contemporary Translation Studies*. London: Routledge.
- He, Juan (2005). Qingmo minchu huaxue jiaokeshu zhong yuansu yiming de yanbian—huaxue yuansu yiming de queli zhi yanjiu (I) (The evolution of Chinese terms for elements in chemistry textbooks in the late Qing Dynasty and the early period of Republic of China—study on the establishment of Chinese terms for elements (I)). Zirankexueshi yanjiu (Studies in the history of natural sciences), 2: 165-177.
- Kametaka, Tokuhei, tr. Yu Mingxin (1902). Huaxue jiangyi shiyan shu (*Lectures on Chemistry—A Book of Experiments*). Shanghai: Popularization Press.
- Amelung, Iwo, Michael Lackner & Joachim Kurtz (2001). "Introduction". In Michael Lackner, Iwo Amelung and Joachim Kurtz (eds.). *New Terms for New Ideas: Western Knowledge and Lexical Change in Late Imperial China*. Leiden: Brill, 1-12.
- Li, Guilin, Qi Mingxiu & Qian Manqian (ed.) (1995). Zhongguo jindai jiaoyushi huibian: putong jiaoyu (*A Collection of the Materials of the History of Modern Education in China—General Education*). Shanghai: Shanghai Education Press.

- Li, Nanqiu (1993). Zhongguo kexue wenxian fanyi shigao (*A Sketch of the Historical Literature of Science translation in China*). Hefei: University of Science and Technology of China Press.
- Li, Nanqiu (1996). Zhongguo kexue fanyi shiliao (*Materials of the History of Science translation in China*). Hefei: University of Science and Technology of China Press.
- Li, Xinghua (ed.) (1997). Minguo jiaoyushi (*The History of Education of the Republic of China*). Shanghai: Shanghai Education Press.
- Ma, Junwu (1918). Shiyongzhuyi zhiwuxue jiaokeshu (*A Textbook of Botany*). Shanghai: The Commercial Press.
- Métailié, Georges (2001). "The Formation of Botanical Terminology: A Model or a Case Study?" In Michael Lackner, et al (ed), *New Terms for New Ideas: Western Knowledge and Lexical Change in Late Imperial China*. Leiden: Brill, 327-338.
- Montgomery, Scott L. (2000). *Science in translation: Movements of knowledge through cultures and time*. Chicago: University of Chicago Press.
- Qu, Xingui & Tang Liang (eds.) (1991). Zhongguo jindai jiaoyushi huibian: xuezhi yanbian (*Collection of the Materials of the History of Modern Education in China—Evolvement of Education System*). Shanghai: Shanghai Education Press.
- Ren, Hongjun (1934). Kexue jingshen lun (On the spirit of science). In China Science Society (ed). Kexue Tonglun (*General Discussions on Science*). Shanghai: China Science Society.
- Sanetou, Keishiyu. tr. Tan Ruqian & Lin Qiyan (1983). Zhongguoren liuxue ribenshi (*The History of Chinese People Studying in Japan*). Beijing: Sanlian Publishing House.
- Sapir, Edward (2000). *Language: An Introduction to the Study of Speech*. New York: Bartleby Com.
- Still, tr. Sino-Western Translation Society (1903). Huaxue (*Chemistry*). Shanghai: The Commercial Press.
- Sun, Yat-sen (1985). Sunzhongshan quanji (VI)(*Collected Works by Sun Yat-sen* (VI)). Beijing: The China Publishing House.
- Tan, Ruqian (1980). Zhongguo yi riben shu zonghe mulu (*The Comprehensive Bibliotheca of China's Translated Books from Japan*). Hong Kong: The Chinese University Press.
- Ueno, Kiyoshi. tr Wang, Jiayan & Zhang Tinghua (1909). Da daishuxue jiangyi (*Lectures on Algebra*). Shanghai: The Commercial Press.
- Wang, Guowei (1994). Lun xin xueyu zhi shuru (On the importing of new words). In Haining wangjing'an xiansheng yishu (XIV)(*Writings by Mr. Wang Jing'an from Haining* (XIV)). Quote from Xiong, Yuezhi. Xixue dongjian yu wanqing shehui (*Western Knowledge Flowing Eastward and the Late Qing Dynasty*). Shanghai: Shanghai People's Publishing House.
- Wang, Jianjun (1996). Zhongguo jindai jiaokeshu fazhan yanjiu (*On the Development of Modern Textbooks in China*). Guangzhou: Guangdong Education Press.
- Wang, Li (1971). Xiandai hanyu yufa (*Grammar of Modern Chinese* (II)) Beijing: China Publishing House.
- Wang, Li (1985). Zhongguo xiandai yufa (*Modern Grammar of China* (II)). Beijing: The Commercial Press.
- Wang, Li (1990). Hanyu cihuishi (The history of Chinese vocabulary). In Wang Li wenji (XI) (*Collected Works by Wang Li* (XI)). Jinan: Shangdong Education Press.
- Wang, Lida (1958). Xiandai hanyu cong riyu jie lai de cihui (Borrowed words from Japanese in modern Chinese). *Journal of Chinese Language*, 2: 90-94. Also in Beijing Research Institute of Cultural Communication between China and Japan (ed).(1982) Zhong ri wenhua jiaoliushi wenji (*An Anthology of Papers on the History of Cultural Communications between China and Japan*). Beijing: People's Publishing House.
- Wang Yangzong (1995). Jiangnan zhizaoju fanyi shumu xin kao (A new catalogue of the translated books by Jiangnan Arsenal, 1868-1912). Zhongguo keji shiliao (China historical materials of science and technology), 2: 3-18.
- Wang, Zhijun & Chen Mengqin (1993). Zhongguo shenglixueshi (*A History of Physiology in China*). Beijing: Beijing University of Medicine.
- Wen, Changbin (2005). Zhongguo kexueshe wei tongyi keji yiming er jinxing de gongzuo (The work done to unify translated technical terms by Science Society of China). *Science and technology and dialectics*, (5): 86-92.
- Wright, David (2000). *Translating Science: The Transmission of Western Chemistry into Late*

Imperial China, 1840-1900. Leiden, Brill.
- Xiong, Yuezhi (1994). Xixue dongjian yu wanqing shehui (*The dissemination of Western learning and late Qing society*). Shanghai: Shanghai People's Publishing House.
- Yan, Fu (1895). Yuan Qiang (Examining strength). In Wang, Shi (ed.) (1986) Yan Fu ji (II) (*Collected Works by Yan Fu* (II)). Beijing: China Publishing House.
- Yan, Fu (1986). Yan Fu ji (II) (*Collected Works by Yan Fu* (I-IV)). Wang, Shi (ed.) Beijing: China Publishing House.
- Yang, Gen (1986). Xu Shou he zhongguo jindai huaxueshi (*Xu Shou and the History of Modern Chemistry in China*). Beijing: Science and Technology Literature Press.
- Yang, Weixin (1994). Qingmo Beijing xuebu bianyi tushuju luekao (A brief study of the Book Translation Bureau of the Beijing Education Commission in the late Qing Dynasty). Beijing chuban shizhi (*Records of the History of Publication in Beijing*), 1: 143-150.
- Ye, Zaisheng (1995). Chubanshi yanjiu (*Researches of the History of Publication*). Beijing: China Books Press.
- Zeng, Ming (2005). Fanyiguan de kexue he jishu yiyi (The scientific and technological significance of the Translation House in Jiangnan Arsenal). Shanghai zaochuan (Shanghai shipbuilding), 2: 24-26.
- Zhang, Jinglu (1957). Zhongguo jindai chuban shiliao (II) (*Materials of the History of Modern Publication in China* (II)). Beijing: China Publishing House.
- Zhang, Xiaoping & Pan Yanming (1986). Zhongguo jindai keji qikan jianjie (A brief introduction to the science magazines in modern China). In Ding, Shouhe (ed.) Xinhaigeming shiqi qikan jieshao (IV) (*An Introduction to the Magazines around the Revolution of 1911* (IV)). Beijing: People's Publishing House.

Biography

Fan Xiangtao, associate professor at Nanjing University of Aeronautics and Astronautics (NUAA), P.R. China, completed his PhD in Shanghai International Studies Universities in 2003 and undertakes research in Translation Studies. His present research interests are pure theoretical studies and theoretical considerations in translation, particularly in specialised translation, through the history of China.

Email: fanxiangtao@163.com