高等教育“十三五”部委级规划教材

科技英语与科技翻译

ENGLISH FOR SCIENCE AND TECHNOLOGY AND SCIENTIFIC-TECHNICAL TRANSLATION

周邦友 主编

東華大學出版社

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Preface

As can be seen, English has now become a global language for the two probably main purposes: scientific and technological exchange and import-export trade. An important statistic is that two-thirds of all scientific papers are published in English—the Science Citation Index reports that as many as 95% of its articles were written in English, even though only half of them came from authors in English-speaking countries—and that up to half of all business deals throughout the world are conducted in English. That is why the academic community started to do studies on English for Science and Technology (EST) and English for Specific Purposes (ESP) as early in the sixties of the last century. Till the first decade of this century such studies focus on interdisciplinary and specialization, which have a great influence on what has been named as Academic and Professional Languages.

English for Science and Technology (EST) is a peculiar segment of the language, with its major component — terminology, to which some authors add the science-specific grammar, i. e. linguistic issues and particularities. The language of science is precise, clear and unambiguous, in which impersonal statements, logical thinking, clear, accurate but concise descriptions prevail, while hyperbole, word play, humor or affective connotations are completely absent. Therefore, a conclusion can be reached that EST is characterized by less culture-bound vocabulary—scientific and technical abbreviations, eponyms, words of Latin or Greek origin; long nominal constructions; noun compounds; impersonal statements; rather long sentences; less frequent use of interrogative or exclamatory sentences but frequent use of non-finite verbs, ellipses, present tenses, and non-verbal items such as graphics, models, figures and tables, etc.

Where the translation of scientific and technical texts is concerned, the primary goal of the translators is to convey the message in a clear, concise, and accurate manner. In the process of scientific translation, the most important factor that influences translation is linguistic difficulty, which is defined by the differences between the writing, grammatical and semantic systems of one language and those of the other. As we know, scientific communication depends on two sets of rules: laws of nature and the principles of language. Scientific translators must understand not only the fundamental science they are translating but also the principles of the languages involved. Account should be taken of linguistic features of techno-scientific texts when they translate such texts, especially when

translating scientific Chinese texts into English. This is the exact goal of this textbook — *English for Science and Technology and Scientific-Technical Translation*.

This book provides a highly accessible introduction to the field of EST. Its purpose is to furnish students with not only a fundamental insight into linguistic features (e.g. lexical, grammatical, syntactical) of EST but also the methods and criteria for translating techno-scientific texts. It can be used as the textbook for a course on science- and technology-specific translation or used for individual study. It is intended for both English majors, including translation-oriented English majors and business English majors, and non-English majors such as those who major in science and engineering. In addition, this textbook is designed for versatile educational settings, such as full semester or trimester course, quarter-system course, online education, distance education, or continuing education, etc.

The book is composed of six units. Unit One defines what EST is, gives an overview of the origins and development of EST, differentiates it from general English, and generally briefs students on its linguistic features. The second unit deals with lexical features of EST with respect to terminology, noun compounds, nominalization, word formation, abbreviations, eponyms, and long words. Unit Three is concerned with grammatical features of EST in the aspects of use of passives, which differs from stative statements, ellipses, different use of the definite article, tenses, non-finite verbs, it-constructions, and long sentences, etc. The fourth unit presents the basic criteria and methods for translating techno-scientific texts as well as text analysis. The last two units focus on translation practice based on linguistic features of techno-scientific texts.

This textbook is intended to be a very much practical guide, and to this end each unit ends with exercises including reading comprehension and translation. The principal aim of *English for Science and Technology and Scientific-Technical Translation* is to teach students to cope with input texts, i. e., reading comprehension, in the course. However, students will be expected to produce output texts in translating throughout the course. By means of these input texts, students can acquire linguistic features of EST discourse; through translation practice, they can better their translating skills. In the case of translating scientific Chinese texts into English, they get to know how such linguistic features are reflected in the target texts.

English for Science and Technology and Scientific-Technical Translation is

generally taught within the confines of a single-semester course at advanced undergraduate level or postgraduate level. So it is important for the instructors to know the course plan. It is suggested that each unit provide between 3 and 6 hours of classroom activity with the possibility of a further 1-2 hours on after-class activities. The approximate number of lectures per unit, as a suggested course plan, is shown as:

Unit	English Majors	Non-English Majors
1 What to Know about EST	3	2
2 Lexical Features of EST	5	6
3 Grammatical & Syntactical Features of EST	6	6
4 Criterion, Method and Text Type	4	6
5 Scientific-Technical Translation Practice (I)	6	5
6 Scientific-Technical Translation Practice (II)	6	5

Acknowledgments. In very real sense, *English for Science and Technology and Translating Scientific-Technical Texts* has profited from all those who have, knowingly, or otherwise, helped to shape the ideas that have gone into this textbook. First of all, the author would like to express his profound gratitude and sincere appreciation to many copyright holders for giving permission to reproduce their opinions and thoughts. Secondly, the author is indebted to his colleagues at Nantong University for their important contributions to this book. In particular, the author would like to mention Dr. Zhang, Shibing; Professor Xu, Tuo; Mr. Guan, Yahua; Mr. Du, Ronghui; Ms. Shi, Xuan. In preparing the book, the author is grateful to Ms. Yang, Fang and Ms. Zhou, Jing for having given so freely of their time and support. The author is also thankful to his students at the university from Class 2017 to Class 2020 for their comments on the class materials that evolved into these units. Finally, special thanks are extended to Ms. Cao, Xiaohong for her patience and support over the many years that she and the author have worked on this book.

Zhou, Bangyou
Nantong, March 31, 2019

Contents

Unit One What to Know about EST

Learning objectives

Upon completing this unit, the student should be able to:

- define EST;
- have an overview of the origins and development of EST;
- differentiate EST from general English; and
- know about linguistic features of EST.

English for Science and Technology, called EST for short, is specialized English for non-English speakers who are studying or working in scientific and technological fields. An EST text usually presents facts, hypotheses, and other instances of scientific and technical information. It is not concerned with the forms of written English that editorialize, express emotions or emotionally based arguments or that are fictional or poetic in nature. That is, EST writing is the type of discourse that has as its purpose the transmission of information (fact or hypothesis) from writers to readers; therefore it is used only a limited number of rhetorical functions. It does not, for example, use such rhetorical functions as editorializing, non-logical argumentation, poetic images, or those functions that create emotions such as laughter, sadness, etc.

As it has turned out, English has become the accepted international language of science, technology and commerce as enormous and unprecedented expansion in scientific, technical and economic activity on an international scale. English, therefore, creates a new generation of learners who know specifically why they are learning it: businessmen and -women who want to sell their products, mechanics who have to read instruction manuals, doctors who need to keep up with developments in their field and students whose prospective work would be related to science and technology. The large-scale international scientific, technical and economic developments after World War II, requested for an international language to serve the needs and demands of people. That language is English and it is needed to update people's knowledge or simply do their work in a global labor market. Hence, there are made many attempts to focus on ESP (English for Specific Purposes) and EST.

1.1 Historical Background and Development of EST

English for Science and Technology or EST as one of English learners' courses is

the product of the revolution in linguistics. At the same time as the demand was growing for English courses tailored to specific needs, influential new ideas began to emerge in the study of language. Traditionally, linguistics aimed at describing the rules of English usage, namely, the grammar. However, the new studies shifted attention away from defining the formal features of language usage to discovering the ways in which language is actually used in real communication (Widdowson 1978). One finding of these studies was that the language we speak and write varies considerably, and in a number of different ways, from one context to another. In English teaching this gave rise to the view that there are significant differences between, say, the English of commerce and that of engineering. These ideas married up naturally with the development of English courses for specific groups of learners (Hutchinson & Waters 1987: 7). Then came the studies on English for Science and Technology.

The history of the EST research can be traced back to the 1960s. C. L. Barber is one of the pioneers in this research. He published the article On the Nature of Scientific English as early as 1962. And it was the late 1960s and early 1970s that saw the greatest expansion of research into the nature of particular varieties of English, say, descriptions of written scientific and technical English by Ewer and Latorre (1969), Swales (1971), Selinker and Trimble (1976) and others. Most of the work at this time was in the area of English for Science and Technology and for a time English for Specific Purposes (ESP) and EST were regarded as almost synonymous (Hutchinson & Waters 1987: 7). But there were studies in other fields too, such as the analysis of doctor-patient communication by Candlin, Bruton and Leather (1976).

Generally there are important phases in the history and development of the EST movement. The first phase covers the 1960s and 1970s, when teaching EST focused on the sentence level with the focus laid on the so-called "need analysis". And the need analyses that were carried out mainly concentrated on the lexical and grammatical features of professional registers, such as the language of engineering or the language of medical studies. Researchers discovered, among the most striking peculiarities of EST, for instance, the extensive use of simple present tense, of passive constructions and of noun compounds. "After careful analyses of identified spoken or written discourse, practitioners organized their grammar-based curricula around the features of these special registers. One of the most famous volumes to appear during this period was Swales's *Writing Scientific English* (1971), where chapters are based principally upon the grammatical forms most commonly found in the scientific English register." (Celce-Murcia 1991: 68)

The late 1970s and early 1980s brought about the second phase in the career of EST, in which the sentence level analysis and the focus on grammatical forms started to integrate rhetorical functions as well. Tarone, Dwyer, and Gillette were pioneers of rhetorical analysis in EST. Tarone et. al. (1981) published a research that was intended to examine the function and frequency of passive voice within astrophysics. When comparing the functions of passive structures in these astrophysics journal articles with active voice, they practically performed a rhetorical analysis, stating that passive voice was used by the scientists/authors of the articles when "a. they are following established procedures rather than discussing their own procedural choices, b. they are discussing others' work in contrast to their own, c. they are referring to their own future research, or d. they wish to front (i.e. topicalize) certain information in sentences." (Celce-Murcia 1991: 68-69) Thus, in this second phase the focus of register analysis became more rhetorical, and when talking about understanding language use in EST, more counting of grammatical and/or lexical features was not enough any longer.

The third phase of the evolution of EST integrated the discoveries of the previous two phases (linguistic features and rhetorical elements), as the focus was on the target situation and the oral communication students might need in different professional contexts, which led to the implementation of so-called "notional-functional curriculum". The main pillars of this notional-functional approach were: the communicative purposes (or functions) of the speaker, the setting for language use and the mode of communication, and the keyword of the whole approach is the functional nature of communication. "Therefore in Notional-Functional Syllabuses, instead of having textbook units which are organized grammatically (as in Phase 1), such as *The Present Perfect*, or which consider the purposes of written discourse (e.g. *Article Introductions*), as in Phase 2, there are chapter headings such as *Agreeing and Disagreeing*. Within the chapters, students are provided with sample dialogues taking place in different contexts among different people, thereby exemplifying the language use which realizes a speaker's communicative purposes within a specified context." (Celce-Murcia 1991: 70) As Robinson (1991: 23) points out:

> Earlier studies focused on elements of the sentence and their construction; later cohesion (particularly grammatical cohesion) was an important consideration. Attention then moved to the meanings of forms (notions and functions) rather than their structure and to the study of forms in context.

The fourth phase started in the second half of the 1980s, which was influenced by psycholinguistics. If earlier the focus had been on the discourse and its grammatical features, on the communicative situation or the communicative purpose, now the attention shifted to the strategies used by learners to acquire the language. Hutchinson and Waters (1987) were the first who claimed that the need analyses had to include issues like the measurement of the learners' existing knowledge, their interest in the materials presented, the learners' modalities of storing and retrieving information and their active involvement in curriculum design.

More recently, lexicographers and terminologists have started to focus less on didactic aspects and more on the problem of specialized languages, this time the main question being not necessarily how to teach specialized languages, but what such languages look like. Raquel Martinez Motos (2013) seems to opt for a new term, *Academic and Professional Languages*, a term created and introduced by Alcaraz in his article "Academic and Professional English" (2000). And the first decade of the 2000s can be called the society of knowledge, as "one of the defining features of this society in interdisciplinarity.... And it is also characterized by a tendency toward specialization. As a result, both interdisciplinarity and specialization have a great impact on what has been named as Academic and Professional Languages." (Motos 2013:4)

1.2 ESP, EST and EGP

According to Hutchinson & Waters (1987: 16), ESP in the tree of English Language Teaching (ELT) in fact consists of three branches: i) English for Science and Technology (EST), ii) English for Business and Economics (EBE), and iii) English for Social Studies (ESS). Each of these subject areas is further divided into two branches: English for Academic Purpose (EAP) and English for Occupational Purpose (EOP). An example of EOP for the EST branch is "English for Engineers" whereas an example of EAP for the EST branch is "English for Medical Studies". They hold that ESS is not common, for it is not thought to differ significantly from more traditional humanities-based General English. See Figure 1-1 The Tree of ELT.

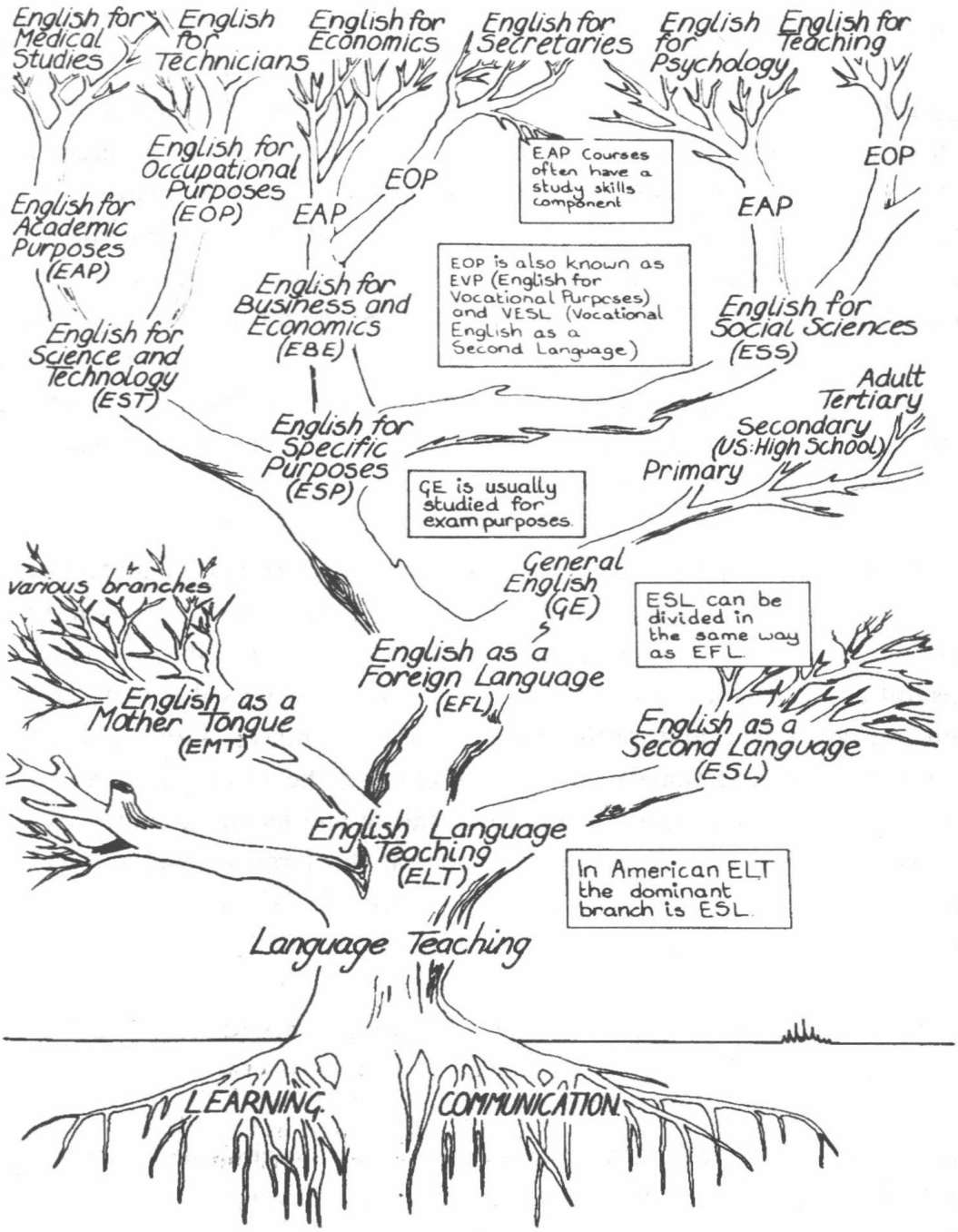

Figure 1-1 The Tree of ELT (Hutchinson & Waters 1987: 17)

Swales (1985: x) in fact uses the development of EST to illustrate the development of ESP in general:

> EST is the senior branch of ESP — senior in age, larger in volume of publications and greater in number of practitioners employed. [...] With one or two exceptions, English for Science and Technology has always set and continues to set the trend in

theoretical discussion, in ways of analyzing language, and in the variety of actual teaching materials.

ESP is the English language taught for professional, vocational, and other specified purposes. Originating in courses of Business English for foreign learners, ESP developed in the 1960s in response to demands for courses geared to practical and functional rather than educational and cultural ends. ESP, in general, addresses learners with a common reason for learning, such as the English of air traffic control or that of dyestuff chemistry. That is, ESP is generally designed to meet specific needs of the learners, especially for intermediate or advanced students. It makes use of underlying methodology and activities of the discipline it serves; it is centered on the language appropriate to these activities in terms of grammar, lexis, register, study skills, discourse and genre.

EST is now and widely viewed as a sub-branch of ESP. To put it another way, EST is a sub category of the larger field of English for Specific Purposes in which it shares some basic characteristics with the larger field of ESP. EST emphasizes purposeful and utilitarian learning of English, and it covers the areas of English written for academic and professional purposes and of English written for occupational (and vocational) purposes, including the often informally written discourse found in trade journals and in scientific and technical materials written for laymen. EST mainly deals with learners at the tertiary level for whom the learning of English takes on a service role for their specific needs in study, work or research.

Both ESP and EST may use, in specific situations, a different methodology from that of General English.

General English can be referred not only to a semi-technical term for English when the language at large is contrasted with a usage, variety, dialect, or register and to a semi-technical term for a course in English within a framework of general education, usually teaching listening, speaking, reading and writing, but also to English for General Purposes (EGP), a term in language teaching for a broadly based, usually long-term EFL or ESL course, in contrast to English for Specific Purposes (Business English, English for Medical Purposes, etc.). As we go down the tree, we can see that GE is usually studied for exam purposes.

Since scientists and technologists attempt to be impersonal and objective in describing natural phenomena and facts, their discoveries (processes and

approaches, etc.), the functions and properties of a discovery, the discourse of EST must be convincingly precise, concise, clear and restricted, which may include equations, formulas, diagrams, tables, etc. Scientists and engineers also prefer to use some typical sentence patterns and a large number of technical and semi-technical terms, which makes English for Science and Technology different to some extent from General English.

Here are two passages in the same subject matter, and one of them is written in the discourse of General English; the other in EST discourse.

Text A

We made a hole in a cork and pushed into it a narrow glass tube. Then we pushed this into the neck of a bottle which we had filled with colored water. When we did this, some of the colored water went up into the tube. We marked the level of the colored water in the tube. Then we put the bottle into a pan of hot water.

Almost at once, the water level in the tube went down a little, but then it started to go up, until the water poured out over the top.

The reason for this is that, when it gets hot, the volume of water increases. The reason why the water level went down at first is that the bottle became hot first and it became a little bigger. The water went up in the tube because, when the water became hot, its volume increased. Nearly all liquids and solids get bigger like this when they become hot.

Next we emptied the bottle and left a small amount of colored water in the tube. We put back the cork and we put the bottle back into the hot water. The water in tube was at once blown out at the top. This is because, when the air in the bottle became hot, its volume increased a lot and very quickly. This shows that the volume of a gas increases quickly when it gets hot.

Text B

After a hole was made in a cork, a narrow glass tube was inserted and the cork was inserted into the neck of a bottle filled with colored water. On doing this, some of the colored water rose in the tube. The level of the colored water in the tube was marked. Then the bottle was placed into a pan of hot water.

Almost immediately, the water level in the tube fell slightly, but then it started to rise until the water overflowed.

The reason for this is that, when heated, water expands. The reason why the water level fell at first is that the bottle was heated first and so it increased slightly in size. The water rose into the tube because it expanded on heating. Nearly all liquids and solids expand in this way when heated.

Next the bottle was emptied, leaving a small amount of colored water in the tube, and the cork was replaced. Then the bottle was replaced in the hot water. The water in the tube was immediately blown out at the top. This was because, when heated, the air in the bottle expanded a great deal and rapidly. This proves that a gas expands rapidly on heating.

Compared with Text A, Text B is clearly written in the way that EST discourse develops. For instance, passive constructions are employed in most contexts instead of actives, which indicates that scientific and technical writing has to be objective. Besides, short words or simple words are used in place of phrases like respective use of "insert" and "overflow" for "push into" and "pour out over the top". By taking the place of when-clause, the writer of Text B uses elliptical clause, such as substituting "when heated" for "when it gets hot", which shows EST discourse is relatively concise. Furthermore, precise wording in EST discourse is considered, as in Text B "proves" is chosen to replace "shows" in Text A.

1. 3 Linguistic Features of EST

In order to learn EST, one must know what EST stands for and what its main features are. Defining the principles that govern the physical world requires a special linguistic code. The language of EST is precise, clear and unambiguous. Impersonal statements, logical thinking, clear and accurate descriptions prevail, while metaphors, humor or affective connotations are completely absent. According to Crystal (1997), EST involves a special vocabulary, which often means a large set of words of Latin or Greek origin, but the development of science and technology and new discoveries impose the continuous renewal or enrichment of this scientific and technical vocabulary.

Neologisms are inextricably linked to language evolution, thus to special languages. "Moreover, scientific vocabulary requires continual updating in the light of the process of discovery. Science is in fact the main birthplace for new

words in a language: in a comprehensive English dictionary, the vast majority of the words would be scientific (or technological) terms, more than 750 000 species of insects have been discovered [...] and if all their names were incorporated into the largest available dictionaries, the books would immediately double in size." (Crystal 1997: 384)

Also, there is a "science-specific" grammar: this means that the language of EST prefers very accurate and unambiguous expressions, which leads to a higher rate of repetitive expressions, to the frequent use of relative pronouns (*which*, *that*, *of which*, *in which*, *where*, etc.) or adverbials, referring to conditions, circumstances, situations. Linking words that express contradiction, explanation, and conclusion are unavoidable. Such linking words are the conjunctions (*and*, *but*, *although*, *though*, *if*, *when*, *since*, *as*, etc.), prepositions (*despite*, *during*, *before*, *after*, etc.) or adverbs (*usually*, *frequently*, *sometimes*, *meanwhile*, *firstly*, *secondly*, etc.). Moreover, there are differences between EST and General English in the use of the definite article and of some modal verbs.

Techno-scientific texts in English often use long and complex sentences, with complex noun phrases, which are known as noun compounds. Another particular feature of EST is the frequent use of passive constructions, which allows the speakers or the writers to be more impersonal, to withdraw from their role of doer and put the emphasis on the experiment or phenomenon that has been carried out or presented. Another aspect that must be mentioned is the use of non-verbal items such as graphics, models, images, tables, etc. Yet, the interpretation or explanation of these non-verbal segments of scientific discourses is verbal.

"The methodology of science, with its demand for objectivity, systematic investigation, and exact measurements, has several linguistic consequences. There is an overriding concern for impersonal statement, logical exposition, and precise description. Emotional comment, humor, figurative expression, and other aspects of personal language are avoided (except in writing for a lay audience)," (Crystal 1997: 384)

From the above a conclusion can be drawn that EST manifests many characteristics typical of ESP, such as vocabulary, grammar, and syntax. For detailed information see Units Two and Three.

In terms of translating techno-scientific texts, considerable account needs to be taken of linguistic features of the texts, whether in the process of translation of