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被動語態在科技論文中的應用

The Use of Passive Voice in Research Articles



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中文摘要

被動語態在教學的過程中通常著重於主動與被動句型的互換。此外，在大多數的英文寫作指引中，被動語態更因為它複雜的結構，不建議學生採用。事實上，被動語態具有允許無生命的科技內容成為句子主詞的特性，而被廣泛的使用在科技論文中。普遍認為，這樣的句子可以讓科技論文讀來更加客觀，進而增加實驗的可信度。但是我們認為被動語態的功能應不僅止於此，也想探討被動語態在言談(discourse)層面的功能。因此，在此篇論文中，我們採用功能語法的觀點來探討有哪些因素會影響被動語態在科技論文中的應用以及被動語態的言談功能。我們的研究問題包括：

- 第一、被動語態的使用在科技與人文領域的論文中是否有所不同？若有所不同，如何從言談功能的觀點來解釋呢？而它的功能在此兩種不同的領域之中又各為何？若在這兩種領域中沒有明顯的差異，那麼是否可歸納出一原則來說明被動語態的使用時機？
- 第二、中國學生在選擇使用主動或被動語態時，是否會因為不清楚動詞中及物與不及物特性而造成誤用？
- 第三、如何從功能語法的觀點來教導研究生能在論文中更有效的使用被動語態？

依據以上的研究問題，本篇論文採用了下列的分析與實驗：

- 第一、我們分析四十八篇人文及科技領域期刊中實驗部份(Methods section)被動語態及主事者的使用頻率與功能。此外，我們也比較了這兩種領域中被動語態的使用時機。
- 第二、因為在試驗性研究(pilot study)中，我們發現了學生似乎會因為不了解動詞及物或不及物的屬性而造成語態的誤用。因此，在此篇論文中，我們設計了一關於及物與不及物動詞和語態選擇的測驗。藉此測驗，希望釐清動詞及物和不及物特性與主動或是被動語態誤用的關係。

根據我們所做的分析與實驗，得到下列的結果：

- 第一、比起人文領域的論文，被動語態在科技論文中更加地頻繁使用。除此之外，主事者(by-agent)在這兩個領域的功能也有所不同。而從言談的觀點，被動語態的使用通常受到論文中訊息及主題體系(information

and theme systems)的影響。

第二、中國學生對某些動詞的及物或不及物的特性可能造成語態的誤用。此外，中國學生也可能因為不清楚動詞與主詞的關係，而選用了錯誤的語態。

第三、我們從言談功能的觀點，設計了一個適合教導研究生在論文中使用被動語態的教案，也提供了一些關於教被動語態的建議。



ABSTRACT

Passive voice is considered as a weak structure rhetorically. Many style manuals claim that active sentences are forceful and interesting while passive voice may complicate sentences and impair readability. However, such a perspective on passive voice restricts its functions to the sentence context and neglects its role in discourse.

Therefore, in this study, we propose a functional approach to the use and choice of voice, focusing on the communicative functions and discourse contexts of voice use. We, firstly, analyze and compare the use of passive voice and its *by*-agents in the Methods Section of 48 research articles in materials science and applied linguistics. Secondly, in a pilot study, we found that students have problems with voice choice in considering the transitivity of verbs. An experiment relating voice use to transitivity of verbs is conducted. The purpose of the experiment aims to find out if transitive/intransitive nature of verbs is the key element contributing to Chinese learners' misuse in voice use. Finally, a lesson plan based on our analysis results is provided. We propose how to teach voice, with particular focus on voice use at the discourse level, in relation to information and theme systems.

Results show that passive voice is used more often in hard science (58.98%) than in social science (31.07%). In both fields, a majority of passive sentences (73.15% and 86.36%, respectively) do not use *by*-agents while those with *by*-agents can be further divided into animate/inanimate groups according to their functions in text. Besides, at the discourse level, we also found that information and theme systems are determining factors in voice choice. As for the experiment, results show that Chinese students may be confused about verbs with both transitive and intransitive natures. Students' unclear ideas about the relationship between verb and subject also contribute to the misuse in voice use. Then, a lesson plan is provided to show how to teach graduate students voice choice in research articles. Finally, pedagogical implications are discussed and some suggestions for future research are also made.

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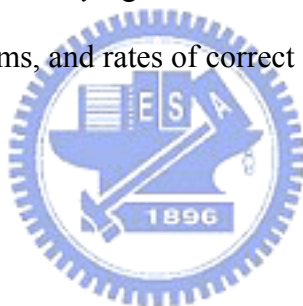
TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	i
中文摘要.....	ii
ABSTRACT.....	iv
CHAPTER 1 INTRODUCTION.....	1
A Functional Approach to the Study of Voice.....	1
Purpose of the Study.....	6
Research Questions.....	6
Significance of the Study.....	7
CHAPTER 2 LITERATURE REVIEW.....	8
The Formation of Passive Voice.....	8
Verb Types in Passive Voice.....	10
Agent in Passive Voice.....	12
Types of Passive Voice.....	16
The Choice of Voice in Writing.....	17
Passive Voice: A Functional Perspective.....	18
Information system.....	20
Theme system.....	24
Text Cohesion.....	29
Thematic Progression.....	32
Genre.....	36
CHAPTER 3 METHODOLOGY.....	41
Data Analysis.....	41
The corpus.....	41
Procedure.....	42
quantitative analysis.....	42
qualitative analysis.....	44
Categorization of <i>by</i> -agents.....	45
The Experiment.....	46
Verbs often confusing Chinese learners in voice use.....	46
The test.....	47
The Motive of Designing a Lesson Plan.....	48

CHAPTER 4 RESULTS AND DISCUSSION	50
Results of Quantitative Analysis	50
The occurrences of active and passive voice	50
The occurrences of agentless and expressed agents in passive voice	53
The analysis of expressed agents in <i>JMS</i> and <i>ESP</i>	54
Results of Qualitative Analysis	58
Voice use in <i>JMS</i>	59
Voice use in <i>ESP</i>	59
Potential factors of voice choice	62
Functions of <i>by</i> -agents	64
Verbs Often Confusing Chinese Learners	66
Ergative verbs in the test	68
Transitive/intransitive verbs in the test	70
Pedagogical Application of Research Results	72
Lesson plan	72
 CHAPTER 5 CONCLUSIONS	 79
Summary of Results	79
The analysis	79
Verbs often confusing Chinese learners	80
Lesson plan	80
Pedagogical Implications and Contribution	81
Voice, Rhetorical Structure, and Genre	82
Limitations of the Study	83
Suggestions for Future Research	83
 APPENDIXES	 85
Appendix A Sources	85
Appendix B Test	90
 REFERENCES	 93

LIST OF TABLES

Table 4.1 Percentages of passive vs. active verbs in <i>JMS</i> sample texts.....	51
Table 4.2 Percentages of passive vs. active verbs in <i>ESP</i> sample texts.....	52
Table 4.3 Average occurrences of active and passive verbs.....	53
Table 4.4 Expressed agents and agentless passive constructions.....	54
Table 4.5 Animate/inanimate agents in the data.....	54
Table 4.6 Sub-categories of animate agents in <i>ESP</i>	56
Table 4.7 Sub-categories of inanimate agents in <i>JMS</i>	56
Table 4.8 Sub-categories of inanimate agents in <i>ESP</i>	57
Table 4.9 Functions and patterns of <i>by</i> -agents.....	65
Table 4.10 Verbs in the test items, and rates of correct and incorrect answers.....	67



LIST OF FIGURES

Figure 2.1 The active-passive relationship.....	9
Figure 2.2 Hierarchy.....	11
Figure 3.1 Procedure of the quantitative analysis.....	43
Figure 4.1 The categories and sub-categories of <i>by</i> -agents in Methods section.....	58



CHAPTER 1

INTRODUCTION

A FUNCTIONAL APPROACH TO THE STUDY OF VOICE

Voice is a grammatical category the meaning and function of which have been traditionally exploited and explained within the constraints of sentence context. For example, Quirk, Greenbaum, Leech and Svartvik (1985) defined it as “a grammatical category which makes it possible to view the action of a sentence in two ways, without change in the facts reported” (p.159). In a popular communicative grammar book, Leech and Svartvik (1975) indicated, “The effect of the change into the passive is to reverse the positions of the noun phrases acting as the subject and object in the active sentence” (p.330). Pedagogically, most discussions and analyses have focused on the form and transformation rule involved in its construction, particularly the possible difficulties and errors as a result of syntactic complexity.

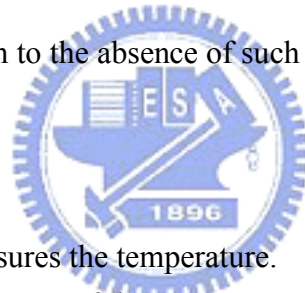
On the other hand, almost all style manuals strongly advocate the use of active voice for forcible writing (Blicq, 1981; Eisenberg, 1982; Neufeld, 1987; Sherman & Johnson, 1983; Strunk & White, 2000; Williams, 2000). They contend that a sentence encoded in active voice can always be more forceful, clearer and stronger. The use of passive voice may complicate the whole sentence, weaken the style, slow down the pace, require more words, and make it more difficult to understand (Blicq, 1981; Eisenberg, 1982; Neufeld, 1987; Sherman & Johnson, 1983). In addition, several studies (Bates & MacWhinney, 1982; Bock, 1982; Bock & Warren, 1985; MacWhinney, 1977) have also legitimized the extensive use of active voice in English writing by examining the nature of subject position. They have found that subject position in a sentence is most likely to be fulfilled with concrete and animate nouns. In other words, active voice often dominates English writing because an agent often

acts as the performer of the action of the verb and, in turn, possesses these two qualities (Fillmore, 1968; Lakoff, 1987). Therefore, the notion of “constructing sentences in active voice” has become an advice to all novice writers.

However, such perspectives towards the use and choice of voice in writing are severely restricted, neglecting the role of voice in organizing information at the discourse level and its relationship with different text features and communicative purposes in a wide variety of genres (Lock, 1996). Although active voice is stylistically preferable, researchers have found that a passive sentence can be more appropriate than its active counterpart under some circumstances. For example, studies in English for Science and Technology (EST) (Cooray, 1965; Duskova & Urbanova, 1967; Fernalld, 1977; George, 1963; Master, 1991; Robinett, 1980; Swales, 1976) have identified the use of passive voice as a major characteristic of the writing in this particular field. A number of studies (Heslot, 1982; Martínez, 2001) have examined the distribution of passive construction in the macrostructure I-M-R-D (Introduction, Methods, Results and Discussion) of scientific research papers and even further claimed its dominant status in Methods section. In order to reduce the involvement of human factors and to emphasize that experimental results can be replicated, passive voice is usually applied in order to focus on the technical information, which is usually realized as the object in an active sentence, by fronting it to the subject position. On the other hand, passive voice also functions to downplay the role of the researcher in an optional status which features the objective register of scientific investigation (Huckin & Olsen, 1983; Quirk, Greenbaum, Leech, & Svartvik, 1972; Royds-Irmak, 1975). As a result, passive voice is considered a syntactic device that facilitates the information-oriented characteristic of scientific articles and shifts readers’ attention to the procedure, equipment, and results in research.

Two studies on EST have specifically examined occurrences of passive and

active voice in scientific texts in detail. Tarone, Dwyer, Gillette and Icke (1998) analyzed two astrophysics journal papers and proposed three discourse functions of passive voice in astrophysics papers: (1) to indicate established or standard procedure; (2) to contrast the present study to others; (3) to propose researchers' future work. Another study by Master (1991) examined voice choice in articles from an American magazine, *Science News*. He interpreted voice use in scientific magazine articles by analyzing the relationship between subjects and verbs. It was suggested that if subjects are of abstract or instrumental nature, the sentences are more likely to be constructed in active than in passive voice; in other words, sentences containing active verbs with inanimate subjects are common in scientific texts. In the same study, however, Master found that nonnative students rarely produce this type of sentences. He attributed this phenomenon to the absence of such an anthropomorphic structure in some languages. For example,



[1.1a] A thermometer measures the temperature.

[1.1b] We make a measurement of the temperature with a thermometer.

[1.1c] A measurement of the temperature is made with a thermometer. (Kojima & Kojima, 1978, p. 207)

Sentence [1.1a] is often encoded as [1.1b] and [1.1c] by many Japanese learners because they find [1.1a] anthropomorphically unacceptable. Master suggested the concept that “English allows an active verb with an inanimate subject only when the verb represents an inherent aspect of function of that subject” (p.18). Thus, sentence [1.1a] is acceptable due to a thermometer’s inherent function of measuring the temperature. However, many Japanese learners fail to produce sentences like [1.1a] because they lack the concept Master indicated above.

In fact, other studies (Chang, 1987; Tanabe 2001) have also suggested that the

interference of L1 may be the main reason for EFL students' mistakes when they use passive voice. Tanabe examined 59 sentences in passive voice produced by 22 Japanese senior high school students. The result shows that among these 59 sentences, 43 of them are reported unacceptable, 13 need restructuring, and 3 should be revised to active construction. Tanabe concluded that since Japanese forbids subject position to be taken by nonreferential/indefinite noun phrases, Japanese learners may fail to construct English sentences initiated by this type of phrase, and, in turn, voice use is affected. In other words, Japanese learners may tend to use unsuitable voice in a sentence because of the restriction on the subject. Chang (1987) claimed Chinese students fail to use passive construction because of the following two reasons: (1) Chinese learners usually mistakenly view the initial noun phrase in the subject position as the real agent in an English passive sentence; (2) Chinese learners tend to use active instead of passive voice even when they know the sentence should use *bei*-construction in the Chinese counterpart. She claimed that the incorrect transfer of Chinese *bei*-construction to English is the major obstacle in Chinese students' learning process of passive voice. In addition, Chang proposed that even after acquiring English passive construction, students still find it difficult to appropriately apply it to their writing due to their unawareness of the function and meaning of passive voice construction.

Another area of research has also contributed to the possible factors of voice choice. Studies on coherence and rhetorical principles in writing have revealed that voice choice is closely related to the selection of theme/rheme and the pattern of thematic development (Bloor & Bloor, 1995; Gramley & Pätzold 1992; Lock, 1996; Shaw 1992). The given-new rhetorical principle can also determine what information to thematize. These studies have pointed to the critical roles of context and intended message in the explication of syntactic structures.

Following these studies, a functional approach towards the use and choice of voice is taken in this research. Functional grammarians perceive language as a system of communication. They are concerned with the communicative functions and the discourse context of a grammatical category or syntactic structure (Lock, 1996). More specifically, they extensively explore the concepts of context, including the relationship between form and meaning, the participants, the action, the intent and effect of the communication, and the genre and norms of communication (Halliday & Hasan 1985; Hymes, 1967).

From such an approach, the study of voice not only transcends the syntactic derivations of active and passive sentences but also highlights the dynamic and pragmatic roles of voice and voice choice in communication. We, therefore, intend to investigate the use of passive voice from a functional approach and the relationship between subjects and verbs.

Although some studies have related nonnative students' difficulty in voice choice or passive construction to the interference of L1, as discussed above, few studies have investigated possible factors of voice choice in research articles. Besides, despite a few studies on the use of passive and active voice in scientific research papers, a functional approach to voice choice as well as the role of voice in relation to generic features of scientific research articles has not been proposed. If passive voice is widely applied in constructing this particular genre, what specific communicative functions and discourse contexts of the genre contribute to such a choice? Or are there high levels of rhetorical writing principles that dominate the extensive use of passive voice? The present study, therefore, was motivated, firstly, to inspect the frequency of active and passive voice in research articles in both hard and social sciences. Secondly, we desire to identify factors influencing voice choice. Thirdly, we also expect to identify and discuss verbs often confusing Chinese learners when choosing between

active and passive voice. At last, a lesson plan will be provided, which aims to suggest how to combine the concepts of coherence and cohesion, given-new information and thematic development into graduate students' writing class. It is hoped that the present study can find out how the high-level rhetorical functions affect the use of passive voice to achieve effective communication.

PURPOSE OF THE STUDY

Based upon the above notions and premises of voice, the present study was aimed to

- (1) explore the role of voice at the discourse level by taking a functional approach,
- (2) examine empirically voice use in research articles in different disciplines,
- (3) clarify determining factors of voice choice,
- (4) identify verbs that may confuse Chinese learners in voice choice, and
- (5) provide pedagogical implications for teaching voice.



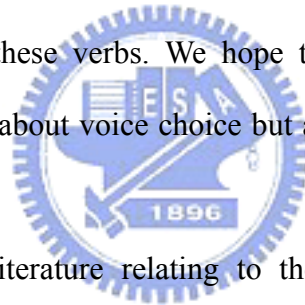
RESEARCH QUESTIONS

Following are the specific questions the study intends to answer:

- (1) What are the relative occurrences of active or passive voice in research articles?
- (2) Does disciplinary difference (hard science and social science) influence the occurrences of active and passive voice?
- (3) Are there any governing principles of voice choice in research articles?
- (4) What is the relationship between voice use and the selection of theme/rheme or thematic development in research articles?
- (5) Do ergative and intransitive verbs result in Chinese learners' misuse in voice?

SIGNIFICANCE OF THE STUDY

Few studies have discussed voice use in the light of the relationship of verbs and subjects, or of voice and discourse context. As a result, in the present study, we intend not only to compare the use of active and passive voice in hard and social science but also to investigate the factors influencing voice choice from the perspective of discourse organization. It is hoped that we can suggest general guidelines that govern the use of active and passive voice at the discourse level, particularly in the genre of research articles. Secondly, we examine how the relationship of verbs and subjects has impact on voice choice. The verbs that confuse Chinese learners are identified and further explored according to their transitive or intransitive nature. Besides, we also propose a way to teach Chinese learners how to choose between active and passive voice when they encounter these verbs. We hope that this study can provide not merely illuminating concepts about voice choice but also new viewpoints in teaching voice for EAP/EST teachers.



In the study, existing literature relating to the formation, classification and functions of passive voice will be discussed in detail in Chapter Two. Chapter Three, Methods section, will be divided into two parts. The first part presents the quantitative analysis of voice use in two journal articles and how the results of quantitative analysis are further interpreted qualitatively from a discursal/generic perspective. The second part explains the design and process of an experiment of confusing verbs in voice use. In chapter four, results of our analysis of voice use in research articles and of problematic verbs in voice use are reported and discussed. Besides, a lesson plan concerning the teaching of the relationship between voice and discourse organization is suggested. In Chapter Five, we will summarize the findings of the study, provide pedagogical implications and propose suggestions for future research.

CHAPTER 2

LITERATURE REVIEW

A number of research areas are involved in the investigation of voice: traditional grammar, general writing theories and practices, functional grammar, research on voice, scientific writing, and genre analysis of research articles. Therefore, in this chapter we will review literature in these areas, focusing on their relationship with the present study. Firstly, we will discuss passive voice in traditional and functional grammar. The form of passive voice, its transformation rules, verb types, and agents are presented. Two kinds of passive voice and the different meanings they represent are explicated. Then, general concepts about the use of active and passive voice in English writing are summarized. Next, voice use will be discussed from the perspectives of functional grammar and discourse organization. Information and theme systems will be introduced. We will present the relationship between voice choice and text cohesion. Thematic progression is further analyzed in order to show how the organization of text may influence voice use. At last, since voice choice in scientific research articles will be specifically explored, we will finally investigate the role of voice in scientific rhetoric in existing research, particularly from the perspective of genre analysis.

THE FORMATION OF PASSIVE VOICE

In English, an active sentence begins with the performer of the action (agent) and ends with the receiver of that action, if the verb is transitive. In other words, active voice places the former in the subject position and the later as object. For example, *John kissed Mary* (Quirk et al., 1972, p. 802). In contrast, a passive sentence allows the object of its active counterpart to be placed in the subject position while the

original subject in the end, following the preposition “by.” The main verb is then changed to “be + verb –en.” For example, *Mary was kissed by John*. The active-passive relationship in form can be illustrated by the following figure.

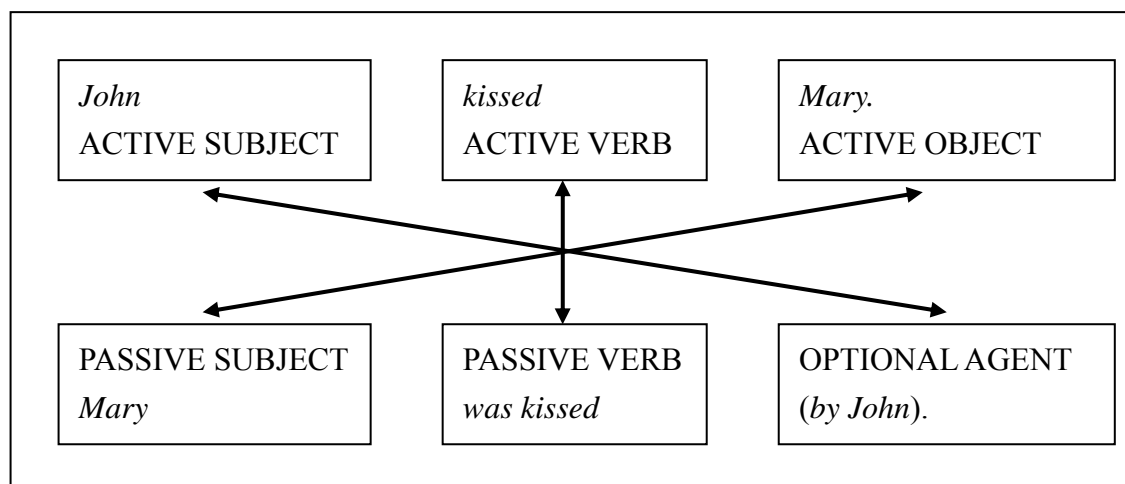


Figure 2.1 The active-passive relationship
(from *A Grammar of Contemporary English*, p.802)

Since in English the subject position is “the strongest position in a sentence” (Master, 1986, p.59), a writer tends to place important information in this position to secure attention from the reader. If a sentence begins with a weak subject—bearing little or redundant information, the reader may miss the point. Therefore, voice creates the possibility for a writer to emphasize either the performer or the receiver of an action by the decision of the subject position, as indicated above. The formation of an active or passive sentence depends much on the writer’s perspective of the relative importance of the performer and the receiver, and hence, the determination of the subject of a sentence. From another viewpoint, we can also say that a sentence in active voice perceives the event from the perspective of the agent whereas one in passive from the perspective of the entity affected (Delahunty & Garvey, 1994, p.160).

One more point is worth our extra attention. When an active sentence is transformed into passive, the agent becomes a modifier of the sentence and, as a result,

can mostly be omitted. However, this omission also causes the shift of focus in the sentence. We will explicate this point in detail later.

VERB TYPES IN PASSIVE VOICE

As mentioned before, when the transformation rule of passive voice is applied, the object in an active sentence is changed into the subject. Therefore, the verb must be transitive in order to transform an active sentence into a passive one. Three types of verbs can be passivized: (1) monotransitive verbs, (2) ditransitive verbs, and (3) object-complement verbs. In the following, we will discuss how to construct passive sentences with these three types of verbs.

Mono-transitive verbs refer to verbs taking only one object. This type of verbs has the simplest active-passive transformation. Figure 2.1 shown earlier is the standard procedure to passivize a sentence with a monotransitive verb.

Ditransitive verbs can take two objects, direct and indirect ones. For example, *Ed gave Liz the money*. With ditransitive-verbs, the passive construction becomes more complicated. It can be either “*Liz was given the money by Ed*” or “*The money was given Liz by Ed*.” Nevertheless, researchers hold different views concerning the acceptability of the passive sentence with the indirect or the direct object of the original active sentence as the subject. Dalrymple (2001) claimed that the direct object can be placed in the subject position only when no indirect object is present, while Huddleston (1984) proposed that the passive form which begins a sentence with the direct object is less frequently used and more marked. Dik (1989), from the view of functional grammar, explained the phenomenon with the following hierarchy:

- a. If a language has P, then it also has Q.
- b. If a language has Q, then it also has R.
- c. Then, P, Q and R can be ordered as:

$$P \rightarrow Q \rightarrow R$$

Figure 2.2 Hierarchy

(Adopted and modified from *The Theory of Functional Grammar*, p.28)

He proposed that R is the most “fundamental” element of the three since “when we find P, we can predict Q and from Q we predict R” (Dik, 1989, p.28). Thus, the relationship among P, Q, and R should be “R > Q > P” (p.28). Dik encoded the symbol “>” as “is more central.” As a result, we can say that R is used more often and central than P and Q. Such processes are termed “hierarchy” or “priority.” Following the idea, the Animacy Hierarchy (p.34), human > other animate > inanimate force > inanimate, can be applied here to explain the reason why for most people “*Liz was given the money by Ed*” is more acceptable than “*The money was given Liz by Ed.*” In addition, since proceeding from the left to the right represents the degree of subject accessibility from the more central and easier to the more peripheral and difficult one, some native speakers may view it acceptable to encode the direct object in an active sentence into the subject in the passive.

The last verb type is called object-complement verbs which require an object as well as a complement in a single sentence. The verbs in this category include words like *consider*, *set*, and *name*. These three words can form active sentences as follows:

- [2.1a] She considers him a liar.
- [2.2a] You should set her free.
- [2.3a] They named the baby William.

In sentences above, “*him*,” “*her*” and “*the baby*” are objects and “*a liar*,” “*free*” and “*William*”, complements. In transforming sentences with this type of verbs from active to passive, objects are assigned to the subject slot while complements remain in the same position. Thus, [2.1b], [2.2b] and [2.3b] form the passive counterparts of [2.1a], [2.2a] and [2.3a], respectively:

[2.1b] He is considered a liar by her.

[2.2b] She should be set free by you.

[2.3b] The baby is named William by them.

To sum up, we may note that, firstly, only transitive verbs have passive form. Thus, the use of words like *happen*, *occur*, *differ* and *exist* in passive form is ungrammatical. Besides, there are words that are not usually used in passive in scientific and technical English, like “*yield*,” “*suffer*,” and “*possess*” (Huckin & Olsen, 1983, p.448). Secondly, for ditransitive verbs, the indirect object in the active sentence is more often encoded as the subject of the passive. Then, for object-complement verbs, the *by*-agent should be put after the complement after passive transformation.

Since passive transformation usually involves the movement of the agent of an action from the most important (subject) position to a peripheral position, or even its deletion, we will discuss the roles and forms of agent in various passive constructions in the next section.

AGENT IN PASSIVE VOICE

Because of the application of the passive transformation rule, agent in a passive sentence becomes an optional modifier. As a consequence, passive sentences can be agentless or agent-expressed.

Most agentless passive sentences are constructed in order to defocus the agent (Master, 1986; Master, 1996; Quirk et al., 1972). For example, in the following sentences, [2.4] claims that it is James Robinson that built the house, while [2.5] focuses on the building of the house and defocuses on the person who built the house by omitting the “*by*” phrase.

[2.4] James Robinson built the house in 1932.

[2.5] The house was built in 1932.

Another possible reason for the omission of agent is the unknown or redundant character of agent in sentences like examples [2.6] and [2.7]:

[2.6] That cake was eaten.

[2.7] English is spoken in London. (Master, 1986, p.60)



Sentence [2.6] intends only to express the fact that “*that cake was eaten.*” We cannot infer from the sentence if the speaker knows who ate the cake. In sentence [2.7], the omission of “*by people*” is justified by the idea that language can be spoken only by people.

On the other hand, agent plays a role in some passive sentences, that is, agent-expressed passives. Agent-expressed passives often imply either the emphasis of the agent or the introduction of new information:

[2.8] That cake was eaten by my little brother.

Comparing sentences [2.6] and [2.8], it is obvious that [2.8] puts emphasis on the idea that it is “*my little brother,*” not anyone else, who ate the cake. Since in English new

information is usually placed near the end of a sentence, “*my little brother*” in this sentence becomes the new information as well as the point of interest. Besides, Chalker (1984, p.90) also claimed that due to the special emphasis on the agent, sentences in agent-expressed passives are rarely semantically the same as their corresponding active counterparts. For example, (Chalker, 1984, p.90)

[2.9] Smokers must occupy rear seats.

[2.10] Rear seats must be occupied by smokers.

Although [2.10] is constructed by passivizing sentence [2.9], it implies “rear seats are to receive special treatment” (p.90) while [2.9] emphasizes smokers’ obligations to take rear seats.

In addition, agent-expressed passives can be further classified into “*by-agent*” and “*how-agent*.” The most salient difference between these two lies in the concept that “*by-agent*” intends to present the cause (someone or something) of the action and is normally realized by the preposition “*by*,” whereas “*how-agent*” expresses the purpose and intention of the action or the instrument used to act. Unlike “*by-agent*,” “*how-agent*” can use both “*by*” and “*with*” (Master, 1986, pp.64-65). Master differentiated these two with examples [2.11] and [2.12]:

[2.11] The man was killed by a stone.

[2.12] The man was killed with a stone.

He contended that [2.11] expressed that the stone is the cause of a man’s death. Sentence [2.12], however, implies that the stone is the weapon used by another person to kill the man. Quirk and Greenbaum (1973) further pointed out that “*how-agents*” can never recover its active correspondences due to its real role as instruments, not as

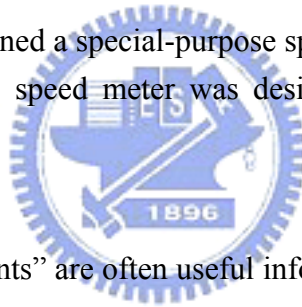
agents. In other words, the sentence “A stone killed the man” is the active form of [2.11], but not of [2.12].

In addition to the semantic difference between “*by-agent*” and “*how-agent*,” the linguistic realizations are different. “*How-agent*” is often realized by an inanimate noun (phrase) because of its function to represent the means employed in order to perform the action. In contrast, “*by-agent*” is usually an animate noun (phrase) indicating the performer of the action.

In scientific articles, since the focus is usually placed on technical information, which is inanimate, passives transformed from actives with animate subjects often have their “animate *by-agents*” omitted. For example,

[2.13a] The engineer designed a special-purpose speed meter for the product.

[2.13b] A special-purpose speed meter was designed (by the engineer) for the product.



In contrast, “inanimate *by-agents*” are often useful information to the reader in passive sentences and hence expressed. For example,

[2.14a] Acid rain accelerated the loss of forests.

[2.14b] The loss of forests was accelerated by acid rain.

In scientific articles, “*by-agent*” can only be used in passive voice while “*how-agent*” can occur in either active or passive voice. Furthermore, “*how-agent*” can be realized by *by*, *with* and *by means of*. Examples [2.15], [2.16] and [2.17] illustrate these three respectively.

[2.15] It is removed by a screwdriver.

[2.16] It is removed with a screwdriver.

[2.17] It is removed by means of a screwdriver.

TYPES OF PASSIVE VOICE

Passive sentences can be classified into two types in terms of their status. Consider [2.18a] and [2.18b]:

[2.18a] The window was broken by Tim.

[2.18b] The window was broken.

In Huddleston's terms (1984), [2.18a] is an "actional passive" whereas [2.18b] is a "statal passive" (p.322). In the actional passive, "be" is an auxiliary and "break (*broken*)," the main verb. However, "be" in the statal passive is the main verb while "broken" functions as a complement. What's more, actional passives are always recoverable to their active counterparts because of the presence of agents while statal passives are not. Their underlying difference lies in the idea that "actional passives" imply the occurrence of some action while "statal passives" merely express the state resulting from the action. Then, the active sentence corresponding to [2.18b] should be one with a "resultant state" (Quirk & Greenbaum, 1973, p.170), like "Someone has broken the window," instead of "Someone breaks the window." This resultant state, at the same time, contributes adjectival values to the past participles and, consequently, the "be" form of the statal passive can be replaced by other copular verbs, like *appear*, *look* and *seem*. This characteristic, thus, becomes a measure to differentiate actional from statal passives.

In scientific research articles, although statal and actional passives occur, it seems not difficult to tell one from the other because "most statal passives are obligatory agentless" (Huddleston, 1984, p.443). For example,

[2.19] In the study, the result is varied from 2 to 4 cm.

[2.20] The result is explained by the immediate contact of the surface and water.

Obviously, [2.19] is statal while [2.20] is actional.

THE CHOICE OF VOICE IN WRITING

Syntactically, a sentence written in active or passive voice has the same meaning. Semantically or pragmatically, it is possible that the active and the passive sentences are written with different intentions or different focuses. The active clearly presents an event in “who-does-the-action” format while the passive intends to emphasize the receiver of the action and downplay or even omit the doer. However, from a rhetorical point of view, most writing textbooks and style manuals advocate the use of active voice. Two famous style manuals (Strunk & White, 2000; Williams, 2000) clearly convey this concept. Various reasons for adopting active rather than passive voice have been indicated in studies and books on general writing. Blinq (1981) claimed that “passive verbs are weak because they merely pass along information” (pp.319-320). Sherman and Johnson (1983) expressed the same view about passive, indicating that it can cause “the lack of directness” (p.38). Eisenberg (1982) pointed out that passive voice “slows down the pace ... and tends to make the going more difficult for your reader” (p.151). Klammer, Schulz and della Volpe (1992) noted that sentences written in passive mostly require more words than their active counterparts. Rizzo (1985) emphasized that sentences in active voice are more “interesting” due to the “dynamic” action of a subject (p.283). Sanford (1977) even further advised students that whenever they feel their writings are weak, the change of verbs from passive to active can usually makes sentence stronger (pp.152-153).

Nevertheless, other researchers hold different perspectives. For example,

Delahunty and Garvey (1994) argued that the passive can be a useful device when the agent is unknown or unimportant (p.425). Eastwood (1994) also indicated that the choice between active or passive voice should concern “whether the subject is the agent or not, whether we are talking about someone doing something, or about something that the action is directed at” (p.132). Master (1986) maintained the similar idea that topic should be of paramount importance when writers make a choice between these two.

Another factor of voice choice is the nature of text. Quirk and Greenbaum (1973) suggested, “passive is generally more commonly used in informative than in imaginative writing, and is notably more frequent in the objective, non-personal style of scientific articles and news reporting” (p.166). Huckin and Olsen (1983) took one step further by indicating that passive voice is particularly important and prevailing in “describing experimental procedures” and “chemical processes” (p.448) since it implies the possible replication of experiments irrespective of the agent, that is, the researchers, and hence validates the experimental results reported.

In conclusion, a writer’s decision on voice should not be a simple matter of writing style or one based on the intrinsically strong or weak nature of active or passive voice. The factors involved, as indicated in the studies reviewed, may include the role of agent, the topic, and the nature of text. Therefore, voice can be perceived as a device that plays a role at the level of discourse in writing.

In the next section, we will further discuss voice from a functional perspective so as to investigate the role of voice in organizing information at the discourse level.

PASSIVE VOICE: A FUNCTIONAL PERSPECTIVE

Functional grammar, first introduced by Dik, is “a general theory of the grammatical organization of natural language based on the functional view of the

nature of language” (Siewierska, 1991, p.1). It views the organization of language from the perspective of human social interaction, emphasizing the communicative functions of grammar and the appropriate use of a particular linguistic form in a given context. In other words, because the focus of functional grammar mainly rests on communication, the relationship between the forms and functions of language becomes significant. Bloor and Bloor (1995) contended that the same words can convey different functions on the one hand. For example, “Good afternoon” (p.8) carries the function of greeting. However, when a teacher says “Good afternoon” to a student, who enters the classroom after half of the first class, the function is reproach with sarcasm, instead of greeting. Halliday (2004) also indicated that the relationship between forms and functions is complicated and based on the principle that utterances make sense in the very context where they are being said. On the other hand, the identical function can be realized in various ways, as shown in the following examples:



[2.21a] Close the door, Kate.

[2.21b] Can you close the door, Kate?

[2.21c] It seems that you still leave the door open, Kate.

Examples [2.21a] to [2.21c] express the same idea of asking Kate to “close the door” even though it is encoded into sentences with different tones and forms.

Siewierska (1991) claimed formal grammar is structural illustration irrespective of language use. Lock (1996) argued that traditional grammar stresses the grammaticality of sentences and the relation between them instead of “their meanings or their uses in different contexts” (p.1). In contrast, functional grammar not only includes the subareas like semantics, syntax, morphology, and phonology in formal grammar but also views them as tools to achieve “communicative and interactional

functions” (Siewierska,1991, p.3).

How are active voice and passive voice considered in formal and functional grammar respectively? Lock (1996) indicated that formal grammar focuses on the formation of active and passive construction and the transformation rules, explaining how to switch the subject and object position and how to change the form of verb. In contrast, functional grammar is more concerned with questions such as “(1) how the communicative effect of the message in the sentence is different in either active or passive voice; (2) what the effect is of putting agent at the end of a clause; (3) what features of the context may have led the writer to select passive rather than active voice” (p.2). Therefore, voice from the perspective of functional grammar is viewed as a device to promote communication.

In written discourse, voice choice is closely related to thematic progression as the voice of a sentence is usually dependent on the selection of its subject and hence influences subject continuity/discontinuity (Pinkster, 1985, p.115). The use of the same subject in two or more successive sentences can develop subject continuity while the change of either or both of them can cause subject discontinuity.

In the following, we will investigate the roles voice may play in organizing information and facilitating thematic progression from the perspective of functional grammar. Specifically, we will introduce information and theme system and their relation to voice selection. The ideas of theme/rheme, given-new information, text cohesion, texture, and thematic progression are also presented. It is hoped that the discussion can shed light on voice choice in research articles.

Information System

According to Halliday (2004), the function of grammar can maintain the discourse flow by two interrelated and parallel systems: one is “system of

information” while the other is “system of clause” (p.88). The former is made up of information units. The latter, often called Theme system, views clause as a message, and analyzes it as the combination of theme and rheme. In the following, we will first explicate the discourse functions of passive voice in relation to the system of information and its pattern.

The system of information is “a form of discourse organization” (Halliday, 1976, p.175). An information unit is not exactly correspondent to any unit in syntax, but a unit of the same status as a clause. It can be operated within less than a clause or extended to more than one. Thus, one clause may comprise more than one information unit and a single information unit can stretch to more than one clause. It is proposed that information is the interaction between what has been known and unknown or what has been predictable and unpredictable (Halliday, 2004, p.89). The former is often called “given” while the latter is termed “new.” Given information is “recoverable to the hearer” and new information, “non-recoverable” (Halliday & Hasan, 1976, p.27). In other words, given information is what a reader or hearer can refer to in the previous text or “something that is not around at all but that the speaker wants to present as the given for rhetorical purpose” (Halliday, 2004, p.91). On the other hand, new information can be either based on which to be introduced or something not expected by audience. In addition, Bloor and Bloor (1995) noted that given information is an element to enhance the effectiveness of communication since it represents the shared and mutual knowledge as the background in a particular context. Furthermore, a default form of an information unit consists of a given and a new constituent. Halliday (2004) suggested two “natural” ways for structuring given and new information: (1) new information is the position for information focus; (2) the arrangement of information should follow the pattern of given to new. He contended that new information represents a speaker’s choice of information focus.

The element with this feature of prominence, no matter in spoken or written language, is the one that the whole sentence intends to introduce or even center.

Since new information is characterized by prominence, it becomes easier for us to tell “where the new element ends” (Halliday, 2004, p.89) in a given clause. In most cases, new information is recognized as the last element in an information unit. Hence, the usual sequence of an information unit is one in which the given precedes the new (Bock & Irwin, 1980; Chafe, 1979; Daiker, Kerek, & Morenberg, 1986; Kuno, 1980; Prince, 1978; Quirk et al., 1972). This given-new pattern forms a standard order, also known as an unmarked form, in the information system. The following two examples illustrate the unmarked and the marked information structure respectively:

[2.22] Unmarked information structure:

My mom bought a blue sweater yesterday. The sweater is very beautiful.

Given

New

[2.23] Marked information structure:

My mom bought a blue sweater yesterday. Beautiful the sweater is.

New

Given

Kopple (1986) further proved that sentences conforming to the given-new pattern can contribute to text readability because it does not require readers to hold the new information when they wait for the given one. Daiker, Kerek and Morenberg (1986) also claimed that the given-new pattern can contribute to the continuity of thought and “carry the thought further” (p.197). This pattern, therefore, governs the word order of a sentence in context and, in turn, usually determines the subject of the sentence. For example,

[2.24] A scanner moves along the printed text and photographs the words. The words are then converted into electronic signals and sent into a minicomputer.

In [2.24], first note that “*the words*” is new information in the first sentence but becomes old information in the second. Further note that the determination of “*the words*,” the given information, as the subject of the second sentence affects the voice choice of the second sentence.

However, Lock (1996) also noted that the given-new pattern may not be the only influencing factor in voice choice. The underlying element is the context itself. In constructing a sentence, instead of choosing between active and passive voice, writers should first select the most appropriate element and the most important information to thematize in a given context in order to fulfill the purpose of communication (Lock, 1996). For example,

[2.25] What potential remedies exist for the acid rain issue? The experts disagree. Some say new environment laws should be enacted to control the emission of pollutants in the atmosphere. Some say that if we had known how serious acid rain was, we would have planned better to prevent it. Nevertheless, all agree that if the consumption of fossil fuel were reduced, we would have less of a problem. Another possibility is that special scrubbers could be installed in smokestacks to remove a good portion of the pollutants before they get into the atmosphere (Saslow & Mongillo, 1985, pp.141-142).

From the first sentence of [2.25], we can know its purpose is to discuss “*the potential remedies existing for the acid rain.*” In other words, what emphasizes here is different solutions to solve the problem of acid rain. Thus, in the ensuing clauses, when the potential remedies are proposed, that is, “*new environmental laws*,” “*the consumption of fossil fuel*,” and “*special scrubbers*,” they appear at the initial positions and, in turn, affect the voice selected in each clause in order to conform to the purpose of this passage. This phenomenon reflects the idea that in order to achieve communication,

context may play an influential role when writers choose between active or passive voice.

The transformation from active to passive functions to change the given and the new constituents in an unmarked sentence. Most important of all, passive transformation may also allow the agent to become the focus because of its place near the end of a clause (Chen, 1991; Lock, 1996). For example,

[2.26] Despite this system-gridlock tendency, technological innovations do occur. Raymond Nelson's National Research Council Workshop suggests that the explanation is both obvious and paradoxical: technological innovation is produced not by technology but by design (Lock, 1996, p.235).

The first sentence of [2.26] introduces the new information "*technological innovations*." Later, when it occurs again in the sentence "*technological innovation is produced not by technology but by design*," it instead occupies the initial position as given information. Moreover, in this sentence "*by technology*" and "*by design*" not only appear as new information but also function as the most important information, "which is appropriately placed at the end of the clause" (Lock, 1996, p.244). In other words, from the perspective of information system and readability in text, passive voice is no longer merely a grammatical category, but an effective device to promote the flow of information by rearranging the information focus in the sentence and conforming to the given–new pattern. Therefore, from the functional perspective, voice plays a significant role in organizing information flow in discourse.

Theme System

Theme system, to a certain degree, is like information system. Both of them are responsible for the maintenance of the flow of discourse and operate at the clause

level. Therefore, just like information system, theme system comprises two constituents, that is, theme and rheme. In the following, the definition of theme and rheme will be presented first. Then, we will discuss the relationship between theme system and voice.

Halliday (2004) proposed that theme is the element which functions as “the point of departure of the message; it is that which locates and orients the clause within its context” (p.64). Rheme, then, refers to the rest of the message. Since theme in English is often demonstrated by position in a clause, writers usually mark theme by placing it in the initial position. Furthermore, from the perspective of functional grammar, theme is discussed in a larger sense beyond the level of individual clause. Martin, Matthiessen and Painter (1997) suggested that since themes in clauses unite together to form the context of a text, theme system involves “the current point of departure in relation to what has come before, so that it is clear where the clause is located in the text—how its contribution fits in” (p.21). Here, “the current point of departure” refers to theme. The rest of the clause that directs where it moves is called “rheme.” Thus, theme can also be interpreted as the element to present the scope of discourse in order to predicate the following constituent (Dik, 1981, p.130).

In addition to the similarity between the two components (that is, given and new, and theme and rheme) in information and theme system respectively, theme system, like information system, is also divided into unmarked and marked pattern. Since the typical location of theme is at the initial position, grammatical subject and theme often coincide. Thus, when an element functions as both grammatical subject and theme, the clause is said to have an unmarked theme while any clause with a theme not in the initial position is said to have a marked theme. Unmarked and marked themes can be illustrated in the following two examples.

[2.27] Unmarked theme:

His father was born in 1943.

Theme

[2.28] Marked theme:

In 1943, his father was born.

Theme

In [2.27], since the first element (theme), “*his father*,” functions as the subject of the clause “*His father was born in 1943*,” it is an unmarked theme. In contrast, although the subject of [2.28] is also “*his father*” while its theme is “*in 1943*” because it occupies the initial position of the clause “*In 1943, his father was born*.” Thus, [2.28] forms a clause with a marked theme. Following the same concept of marked form in information system, marked theme should also be avoided when writers construct a clause. Researchers (Halliday, 1976; Lock, 1996) have indicated that the transformation from active to passive voice is a device to avoid marked theme. For example,

[2.29] The house, he built in 1983.

[2.30] The house was built in 1983.

As indicated earlier, clauses often take “subject” as “theme” in unmarked theme pattern. Nevertheless, clause [2.29] presents the object “*the house*” in the initial position and functions as theme, which results in the occurrence of a marked form while clause [2.30] constructs an unmarked theme with the inversion of subject and object and application of passive voice. In other words, with the switch of active to passive voice, writers are provided a chance to thematize clause participants such as “Goals, Recipients and phenomena (i.e., participants mapped on the direct and

indirect objects in active voice clauses)” (Lock, 1996, p.233) and avoid a marked theme in a given clause.

Aside from the function to avoid marked theme, we can also observe another significant relationship between theme system and voice. For example (Bloor & Bloor, 1995, p.74),

[2.31] Guitar was played by Ziggy.

Theme

[2.32] Ziggy played guitar.

Theme

In [2.32], it can be inferred that “Ziggy” functions as the point of departure to introduce what Ziggy did—“*played guitar.*” In other words, the aim of [2.32] is to describe Ziggy’s ability or talent in playing the piano. On the contrary, [2.31] frames “*guitar*” as theme and seems to present the lineup of a band, just as “*Piano was played by John, drums by Ali*” (Bloor & Bloor, 1995, p.74). As a result, we can see that although two clauses are constructed with the same constituents, voice choice is related to the selection of theme and rheme.

In research articles, passive voice is generally perceived as a primary device to reflect the objective nature of scientific investigation and the replicability of research irrespective of human agents (Huckin & Olsen, 1983; Quirk et al., 1972; Royds-Irmak, 1975). A number of studies (Cooray, 1965; Duskova & Urbanova, 1967; Fernalld, 1977; George, 1963; Givón, 1993; Heslot, 1982; Master, 1991; Robinett, 1980; Swales, 1976) have further demonstrated the idea by examining its occurrences in scientific research articles. Wingard (1981) proposed that passive voice is used in reporting the sequence of procedure in author’s own research and in depicting procedures usually used by other researchers by analyzing six medical texts. Tarone,

et al. (1998) also investigated the use of voice as well as tense in two astrophysics journal papers and concluded that passive voice occurs in the following three circumstances: (1) describing standard procedurals in experiment; (2) contrasting the author's own research with previous research; (3) indicating further research the author suggests. Nonetheless, only few studies (Gramley & Pätzold, 1992; Shaw, 1992) have related the choice of passive voice to information and theme system in research articles. Gramley and Pätzold (1992) claimed that one of the reasons for using passive in scientific research papers is to front the theme focus, that is, direct or indirect object, by putting it in the initial position in a clause. Shaw (1992) also proposed the relation between voice and word order as follows:

Rhetorical function and/or cohesion determine theme-rheme structure, which determines word order. Word-order determines what shall be the subject and hence determines voice....Voice [is] therefore not chosen to indicate function, but in most cases follow naturally from higher-level decisions (p.312).

We can conclude that, in research articles, the selection of voice concerns more than grammaticality and style. The choice between active and passive voice is not merely a question concerning if agents are either known or important. It is closely related to which information should be the shared knowledge or background and which participant is the most appropriate one to be thematized in a given context. As a result, the use of either active or passive voice in research articles should be examined at the discourse level, particularly the information and theme-rheme system and context.

In the next section, therefore, we will relate passive voice to text cohesion and thematic progression in order to gain more insight on voice selection in research articles.

TEXT COHESION

Before discussing the relationship between text cohesion and voice, we will define the terms “text” and “texture.” A text, according to Halliday (2004), refers to a written product, often treated as a semantic rather than grammatical unit. Therefore, it can be stretched to a super-sentence level, related to more than one clause or even paragraph. We can regard a text as a semantic unit which is “related to a clause or sentence not by size but by realization” (Halliday & Hasan, 1976, pp.1-2). De Beaugrands and Dressler (1981) claimed that a text must accomplish the communicative purpose and, thus, can be defined as a “communicative occurrence” (p.3). In other words, a text is formed only when the communicative purpose is achieved, which means the reader’s interpretation of a text identical with the writer’s intentions in the text. Thus, we can conclude that a text is a unified stretch of meaning that develops communication between the writer and the reader.

“Texture,” as indicated by Halliday and Hasan (1976), is an indispensable feature that makes a clause or paragraph a text (p.2). Texture in English is made up of two components (Halliday, 1977): (1) “cohesive relations,” (Halliday & Hasan, p.2,) including “referential, substitutive-elliptical, conjunctive and lexical,” and (2) Theme system and information system. The four elements in cohesive relations function as “cohesive ties” to connect individual clause into a semantically cohesive entity. With cohesive relations, the presupposed can be easily decoded by the presupposing and the coordination of these two helps the text flow. The following example illustrates the idea (Saslow & Mongillo, 1985, p.33):

[2.33] Robots, already taking over human tasks in the automotive field, are beginning to be seen, although to a lesser degree, in other industries as well. There they build electric motors, small appliances, typewriters, pocket

calculators, and even watches.

In [2.33], readers can interpret the word “*they*” and “*there*” in the second sentence as references to “*robots*” and “*in other industries*” in the first sentence. The interpretation is based on the reason that the presupposing (*robots* and *in other industries*) provides the presupposed (*they* and *there*) a source for reference. In other words, the passage cannot have texture without the cohesive ties between “*robots*” and “*they*” or “*in other industries*” and “*there*.” Therefore, we can say that the presupposing and the presupposed have interdependent relationship to establish a cohesive relation. It can also be generalized that, in [2.33], cohesion is derived from “grammatical dependencies” (De Beaugrands & Dressler, 1981, p.3) because of the identical references of “*they*” and “*robots*” or “*there*” and “*in other industries*.” Then, cohesion can be best viewed as a principal feature responsible for the semantic interrelationship between one item and another and for the continuity of meaning. From the functional perspective, cohesion can be regarded as the connection of components in surface structure that enhances the communication between readers and writers.

On the other hand, cohesion is also claimed to function as a device to reduce redundancy in text (Stoddard, 1991). As shown in [2.33], pronoun “*they*” and adverb “*there*” are used in order to avoid the repetition of “*robots*” and “*in other industries*.” Besides pronouns and adverbs, “epithets with definite articles and displaced or deleted agents” (Stoddard, p.103) are also the usual ways employed. Stoddard exemplified the idea particularly by passive construction. He contended that the application of passive voice depends on whether writers intend to delete agent to avoid text redundancy. For example,

[2.34] One of these relatively new hybrid breeding methods is tissue culture, in which cells are taken from a plant and then grown in vitro in a nutrient solution. In one research project, plant geneticists are striving to develop crops (such as oats) that can grow and reproduce in saline soils, which are a major problem for many farmers. (Saslow & Mongillo, 1985, p.159)

In [2.34], “*plant geneticists*” are deleted in the sentence “*in which cells are taken from a plant and then grown in vitro in a nutrient solution*” to reduce text redundancy because it is implied in the context.

Among the four elements that compose cohesive relations, Halliday and Hasan (1976) suggested that operator ellipsis is the one directly related to voice choice. Operator ellipsis is the ellipsis which functions from the left of the sentence. In other words, what is omitted is only the operator or what we normally called “subject” of a clause. Thus, the subject must be presupposed if operator ellipsis occurs as [2.35] (Saslow & Mongillo, 1986, p.107) suggests.

[2.35] The satellite will have gigantic solar cell panel wings that will stretch several kilometers. The solar panels will convert the sun’s rays into electrical energy, which will then be transformed into microwaves and beamed to an earth-based antenna.

The clause “*which will then be transformed into microwaves and beamed to an earth-based antenna*” in [2.35] is perceived as acceptable because the subject of the clause “*beamed to an earth-based antenna*” is the same as that of the preceding one and omitted. It, therefore, forms a semantically continuous clause. In fact, since subject is always omitted in operator ellipsis, “voice selection must be presupposed if the presupposing group is elliptical” (Halliday & Hasan, 1976, p. 183). Thus, in [2.35] because “*which will then be*” is omitted, voice used in the clause “*beamed to an*

earth-based antenna” must be identical with the preceding clause “*which will then be transformed into microwaves,*” that is, passive voice in this case.

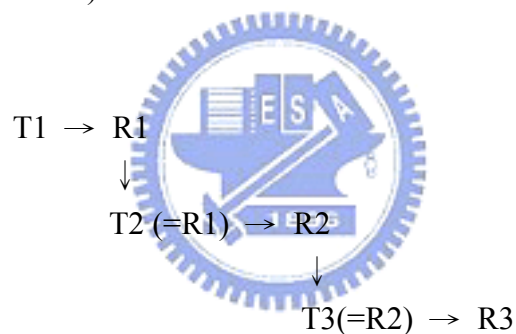
The second component that forms texture is theme and information systems. As indicated in the previous section, since theme is considered as the point of departure in a clause and the element directing the whole clause, the application of the same or interrelated themes in a paragraph appears essential in constructing a cohesive text. In information system, the word order of a given clause is often influenced by the given-to-new principle and also dependent on which element is considered as shared knowledge (given) or which element’s “meaning is non-recoverable in the context” (Halliday, 1977, p.32) (new). In the previous section, we have suggested: (1) from the perspective of theme system, voice selection in research articles is one of the devices to thematize the most appropriate constituent to the initial position; (2) from the perspective of information system, voice may change the focus in a clause by assigning given and new information to either the subject or the object of the clause in order to promote the flow of information. Therefore, voice choice seems to play a critical role in discourse organization since voice selection in one clause might be dependent on the preceding one(s) and affect what comes after as well. The appropriate choice between active and passive voice functions to tie the whole text together by building a solid relationship between the previous and the ensuing clauses.

THEMATIC PROGRESSION

Although information system often requires a sequence of information from given to new, Kopple (1986) claimed that under certain circumstances, new can be fronted before given so that readers may immediately realize what they need to know in order to proceed along a text. In other words, in spite of the given-to-new pattern, the ordering of information can still be varied according to the purpose, genre, and

writer's intention in order to perform specific communicative functions in a discourse. As a result, the choice between active and passive voice appears to be influenced also by these factors. For example, in research articles, the selection of active or passive voice is usually concerned with impersonality of reporting. Nwogu and Bloor (1991), who adopted Daneš' (1974) ideas of thematic progression and its four patterns, however, illustrated information configuration in medical research articles according to the purposes and rhetorical functions in sections of Introduction, Methods, Results and Conclusions.

(1) Simple linear Thematic progression (Thematic progression with linear thematization of rhemes):



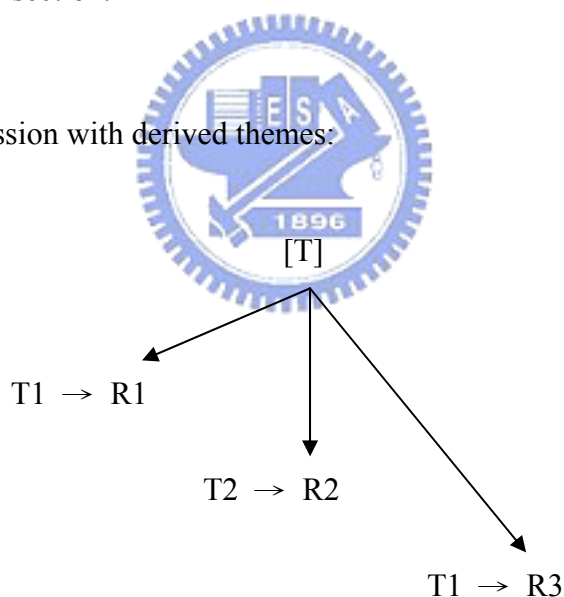
This is the most basic type of thematic progression pattern. The preceding rheme (R) transforms to theme in the following utterance. According to Bloor and Nwogu's investigation, the pattern usually occurs in Introduction and Discussion sections due to their explanative or argumentative nature.

(2) Thematic progression with a continuous (constant) theme:

T1 → R1
↓
T1 → R2
↓
T1 → R3

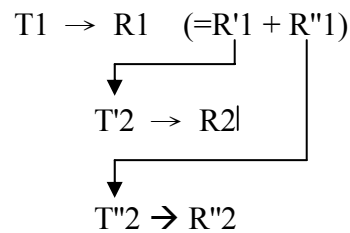
A theme keeps on in text but the rhemes are different in different utterances. What needs to be further explicated here is this same theme may not necessarily be realized in identical wording. Since this pattern often occurs in paragraphs concerning the depiction of a procedure in medical research articles, it may appear in Introduction, Methods and Results section.

(3) Thematic progression with derived themes:



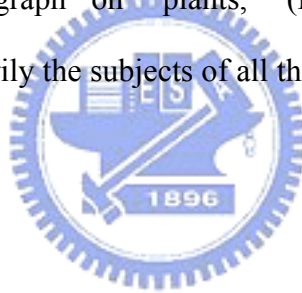
Daneš (1974) indicated that in this pattern themes in various utterances are derived from a “‘hypertheme’ (of a paragraph, or other text section)” (p.120). This pattern often occurs in Discussion section exclusively for its rhetorical function of itemization and serialization of events in medical research articles. (Nwogu & Bloor, 1991)

(4) The split rheme pattern:



This pattern is the combination of (1) and (2) and often occurs when there exist one or several parallel ideas derived from the same rheme. Therefore, it tends to occur in a passage with the function of classification in medical research articles (Nwogu & Bloor, 1991).

In the following paragraph on “plants,” (Master, 1986, p.64) thematic progression determines primarily the subjects of all the sentences in it, and in turn, the voice of them.



[2.36] A plant is a living organism. It is made up of different parts, each with particular purposes of functions. Some parts of the plant may be removed without harming it. Plants such as beets, carrots, and potatoes store food in their roots. Other plants are able to take nitrogen from the air and add it to the soil. These plants are called legumes. If they are plowed under, they make the soil more fertile.

With close observation of theme and rheme in the passage, we can generalize that [2.36] belongs to “thematic progression with a continuous (constant) theme” because the theme of the first sentence is “*plant*” and the themes in ensuing clauses are either the same or related to it.

As implied in the four patterns by Nwogu and Bloor (1991) above, in research articles, information could be organized not only in given-to-new sequence but also in

other patterns depending upon thematic progression, which may, in turn, be determined by the generic organization of information. In different sections of a research article, voice choice as well as thematic progression of text could, therefore, show different patterns. In other words, from the perspective of discourse function and cohesion, the selection between active and passive voice is closely related to the purposes and organization of information of a particular section in a research article.

GENRE

In the previous section, voice use has been investigated from the perspective of functional grammar. We have proposed that the use of either active or passive voice in research articles is influenced by discourse organization, like information and theme systems, text cohesion and thematic progression. However, the type of text, or genre, with its specific generic organization and discourse functions, may also contribute to voice choice. As a result, in the last section, we discuss voice in research articles from the perspective of genre. The definitions of genre and discourse community will be introduced first. Then voice use in research articles as a genre will be discussed.

Traditionally, genre has been viewed as a means to classify written and spoken products and to provide a set of regularities that restrict the content (Paré & Smart, 1994) and a “formulaic way of constructing particular texts” (Swales, 1990, p.33). Genre plays a critical role in composing a text, acting as a “modeling container” (Devitt, 1993, p.575) to shape its content and function. However, in recent years, this traditional concept of genre has gone through severe critics because of its aim to offer a mechanical form. Holmes (1997) suggests that the significance of genre lies in the “communicative purpose and the ways in which communicative needs shape or influence both surface form and deeper rhetorical structures” (p.322). Genre, therefore, can be perceived as a way to “achieve a communicative goal” and “by which a text

realizes its communicative purpose rather than on establishing a system for the classification of genres” (Dudley-Evans, 1994, p.219).

This new concept relating genre to communicative purposes of a text derives from the idea that genre is the response to a recurrent situation (Bitzer, 1968). Bitzer claimed that a genre develops when “comparable situations occur, prompting comparable responses; hence rhetorical forms are born and a special vocabulary, grammar, and style are established” (p.13). In his idea, genre is the application of appropriate responses to the same or similar situations. Devitt uses the genre of “lab report” to explicate this idea. The characteristics of lab report are “a quick statement of purpose or separate methods and results section” (p.576). These features can be interpreted as the appropriate responses to the situation, that is, readers’ intention to find out the purpose and process of experiment within the shortest time in order to decide if the study is valuable or related to their own research.

In addition to Devitt (1993) and Bitzer (1968), there are other researchers illustrating genre from the perspective of communicative purposes. Swales (1990) proposed that

[a] genre comprises a class of communicative events, the members of which share some set of communicative purposes. These purposes are recognized by the expert members of the parent discourse community and thereby constitute the rationale for the genre. This rationale shapes the schematic structure of the discourse and influences and constrains choice of content and style (p.58).

Swales followed Miller’s (1984) and Martin’s (1985) ideas that the identification of a genre does not rely on its form or regularities but on the shared purposes of a particular group, that is, discourse community. In other words, a genre is formed

because particular rhetorical needs are required in a text in order to achieve its communicative purposes. A discourse community, according to Swales (1990), is a group of people with “a broadly agreed set of common public goals” and “mechanisms of intercommunication among its members” (p.25). It uses some specific lexis and “uses its participatory mechanisms primarily to provide information and feedback” (p.26).

Bhatia (1993) extended Swales’ definition of genre to “a recognizable communicative event characterized by a set of communicative purpose(s)” and “highly structured and conventionalized with constraints on allowable contributions in terms of their intent, positioning, form and functional value”(p.13). He claimed that genre is not only linguistic and sociological; a set of regularities of a genre is in fact cognitive since they are the reflection of “the strategies that members of a particular discourse or professional community typically use...in order to achieve communicative purposes” (p.21). Texts which require different strategies to fulfill their communicative purposes should be interpreted as two different genres (p.21-22).

The extensive use of passive voice is often considered a major feature of the genre of research articles. It is believed that the use of passive voice can increase experimental objectivity by fronting inanimate subjects and omitting animate *by*-agents. In order to examine this prevailing concept, Martínez (2001, p.236) investigated the use of active and passive voice in this genre across three disciplines: physical, biological and social sciences. It was found that the majority of sentences in Introduction, Results and Discuss in these three disciplines are constructed in active voice. Furthermore, there exists a slight difference among three disciplines in the percentage of passive voice in Methods section. According to Martínez’s (2001), in physical science, the use of passive voice in Methods section constitutes up to 74% while in social science, it constitutes only 54%. Martínez, citing Múrat (1990), held

that this difference lies mainly in the different natures of the objects in studies of science. In physical science, objects are “inert objects” (p.235). In contrast, social science investigates objects with “an independent capacity to act” (p.235). With this characteristic, the description of experimental processes is more likely to be constructed in active sentences.

Tarone *et al.* (1998) investigated the use of active and passive voice in two astrophysical journal papers. They claim that “not all scientific journal papers consist of reports of experimental studies” (p.115). Moreover, papers consisting of logical arguments, like those in the fields of astrophysics, mathematics and theoretical linguistics may use more active voice than those with experimentations (p.115). The rhetorical structure of logical arguments is like an “inverted pyramid.” For example, in the case of astrophysics, papers start from general physics and observations are conducted through logic and established procedure. Then physical argument relevant to the observations is cited and conclusions are drawn from specific physical conditions. Tarone *et al.*’s research results show that active voice accounts for 88.5% and 81.4% in these two astrophysical journal papers. In other words, the different nature of representation of disciplinary knowledge can result in dissimilar voice use despite their common purpose—to report on research results.

In this chapter, we have first reviewed passive voice from the perspective of traditional grammar. The formation of passive voice, its verb types and the classification and functions of *by*-agents are explicated. Then, the role of active and passive voice in writing is discussed, especially in research articles. We suggest that although the use of active voice is often recommended in some style manuals, we should take into account discourse-level factors such as the nature, topic and communicative purpose of a given text in explaining the choice between active and passive voice. Following this idea, the factors that may influence voice choice are

suggested. We illustrate how discourse organization and information and theme systems have an impact on voice choice by extracting and analyzing sentences and paragraphs from research articles to exemplify their significance. Next, voice is viewed from a broader perspective—text. The appropriate choice of voice and its relation to text cohesion and thematic progression are proposed. Finally, we consider voice in research articles from the notion of genre. Although communicative purpose in the genre of scientific research articles is to report findings, voice use may also vary across different disciplines and rhetorical structures.

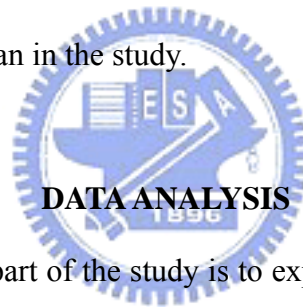
In the next chapter, we will present the research methodology of the study. It consists of two parts: an analysis of the use of active and passive voice in a corpus of research articles, and an experiment of voice choice in terms of the nature of verbs, particularly verbs that easily confuse Chinese learners in voice use.



CHAPTER 3

METHODOLOGY

The study is composed of two parts. The first part is to conduct a detailed analysis of voice use in research articles in both hard and soft science respectively, while the second part aims to examine the voice use of verbs which may often confuse to Chinese students. In this chapter, therefore, the research methodology is illustrated in two subsections—data analysis and experiment. Since we intend to explore the discourse context of voice use, data analysis is further divided into quantitative and qualitative analysis. In experiment, two problematic verb types in terms of voice choice are first introduced and followed by an experiment. At last, we will illustrate our motives to add a lesson plan in the study.



The purpose of the first part of the study is to explore the voice use of active and passive voice in research articles, and the possible factors which influence voice choice in research articles, especially at the level of discourse organization. Thus, the corpus was first compiled.

The Corpus


The corpus consists of 48 research articles in two journals, one in hard science and the other in soft science: *Journal of Materials Science: Materials in Electronics (JMS)* and *English for Specific Purposes (ESP)*. The sections for analyses are entitled “Method(s),” “Methodology,” “Experimental,” or “Present study,” in these research articles. These sections usually describe the research methodology and the process of research. The reason to choose Methods section is that according to studies (Heslot,

1982; Swales, 1990), passive voice is usually extensively used in Methods section. The sample texts from *JMS* range from July 2002 to June 2004; in *ESP*, they range from 2001 to 2004 since *JMS* is a monthly journal while *ESP* is a quarterly.

Procedure

Quantitative Analysis

There were three steps in the quantitative analysis (Figure 3.1). Firstly, we collected the electronic files of 24 sample texts in each journal. Secondly, the occurrences of all verbs, including all finite and non-finite verbs, and both active and passive voice, in Methods sections in each journal were identified and counted respectively. Since no software in the market can identify all the possible variations of verb forms of passive constructions, occurrences of active and passive verbs were manually calculated, including all finite and nonfinite verbs. For example,



[3.1] As Hyde (1990) points out, 'the main pragmatic ingredient of these extrinsic signals would seem to be the especially marked emphasis or prominence that is conferred by full sentence status and its associated informational and intonational features' (1990, p.457). (Text 7b)

Sentence [3.1] contains four verbs, *points*, *seem*, *be*, and *is conferred*. The first three are active and the last one is passive.

Next, *by*-agents in passive constructions were examined in terms of their presence or non-presence since they may have special discourse functions in scientific text. Frequency counts were further conducted for the expressed and agentless passives, respectively. (Details about *by*-agents and their categorization are given later.) The expressed agents were sub-divided into animate agents and inanimate agents. The occurrences of each subdivision were also investigated. Our criterion for

dividing animate and inanimate agents is that if agents are humans or organizations comprising groups of people, like company, they are classified into “animate agents;” otherwise, they are “inanimate agents.” The following are examples of animate ([3.2] and [3.3]) and inanimate ([3.4] and [3.5]) agents from the data:

- [3.2] Data at all sites are collected separately by the three researchers. (Text 11b)
- [3.3] You are management consultants who have been fired by a large US cosmetics company who are looking for new investment opportunities. (Text 2b)
- [3.4] The synchrotron radiation from an undulator was monochromatized by a Si double-crystal monochromator. (Text 12a)
- [3.5] As in other qualitative case studies of L2 literacy, data are collected by various natural means. (Text 3b)

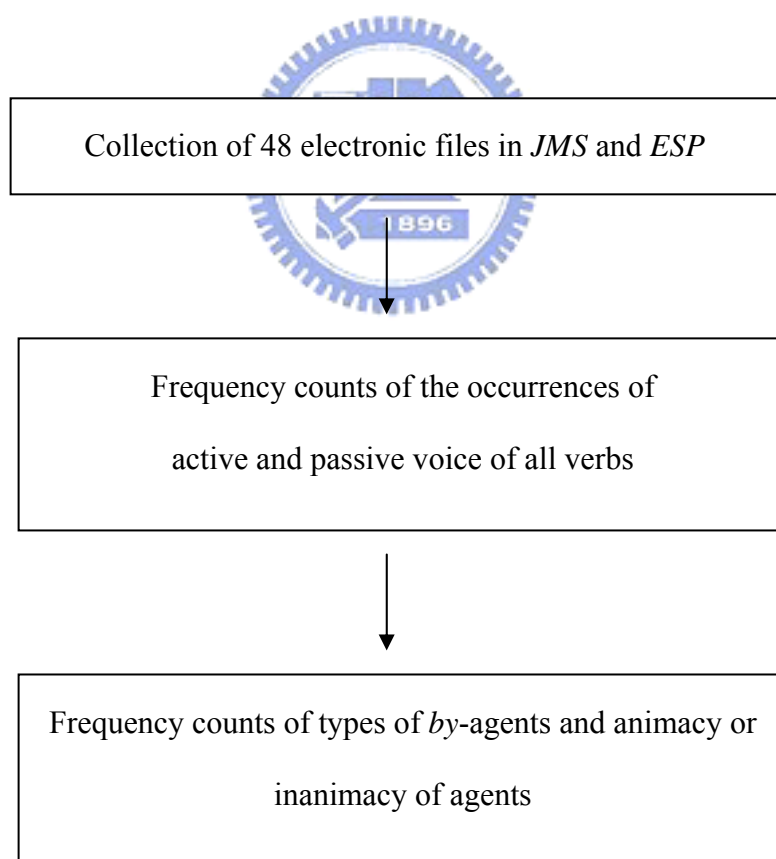


Figure 3.1 Procedure of the quantitative analysis

Qualitative Analysis

Research on voice (Fernald, 1977; George, 1963; Master, 1991; Robinett, 1980; Swales, 1976) has mainly focused on quantitative analysis, such as the frequency counts of both voice forms in journal articles. Generally, these studies have attributed the extensive use of passive voice in research articles to the objective nature and the replicability of scientific investigation (Huckin & Olsen, 1983; Quirk et al. 1972; Royds-Irmak, 1975). However, in our opinion, voice use concerns more than the impersonal writing style in this particular genre. It should be examined beyond the boundary of sentences and discussed at the discourse level, like information and theme systems. Besides, from the perspective of functional grammar, voice use is concerned with communicative purposes. Attention should be paid to how voice choice and absence/presence of *by*-agents influence or are influenced by the context. As a result, qualitative analysis of voice choice in relation to the communicative purposes of Methods section as well as the genre of scientific research articles is critical to provide a better picture of voice use in this genre.

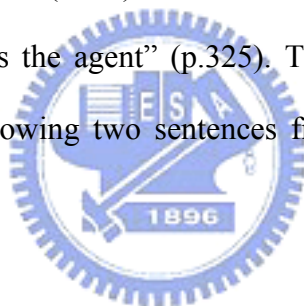
To investigate how information flow or focus, which reflects particular communicative purposes of describing a research method or procedure, may influence the choice of voice, we try to explore the theme and information systems in our sample research articles from a systemic-functional perspective. In particular, passages with continuous subjects and the given-to-new pattern, which relate to theme and information systems respectively, are examined.

To sum up, we qualitatively examine passive constructions in our data in order to (1) provide possible explanations for the results of the quantitative analysis, and to (2) learn whether factors other than objectivity contribute to voice choice in research articles. As indicated earlier, we investigate the contexts where passives or actives occur and compare them, especially in relation to the theme system and the

information system of text in the hope of deriving possible principles that govern voice use in research articles.

Categorization of *By*-agents

In addition to the frequency counts of active and passive verbs, passive constructions were further examined in terms of the presence or non-presence of *by*-agents. They were classified into two categories: expressed agents and agentless (Chen, 1991, pp.51, 53). As indicated in Chapter Two, *by*-agents in passive constructions are generally considered as doers or contributors of the verbs. Nevertheless, in the study, we view both *by*-agents and *how*-agents as expressed agents, following Quirk *et al*'s (1972) idea that “both instrumental and agentive *by*-phrases are said to express the agent” (p.325). Thus, both *by*-agents ([3.6]) and *how*-agents ([3.7]) in the following two sentences from our data were regarded as expressed agents.



[3.6] It was not followed by a colloquium, but there were some questions asked by one student in the middle of the lecture. (Text 3b)

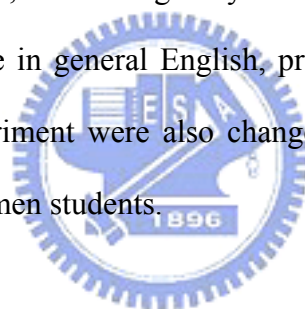
[3.7] The ingot was heated to a certain temperature by induction heating in a vacuum chamber with a flowing gas mixture of Ar + O₂ at a pressure of 1.0 × 10⁴ Pa, where the oxygen partial pressure was kept fixed at about 2 × 10³ Pa by controlling the oxygen flux. (Text 11a)

As indicated in *Procedure*, expressed agents are further divided into animate and inanimate agents. In qualitative analysis, we also want to identify the roles of animate and inanimate agents, respectively, in research articles. For example, we would like to answer questions like “what kinds of animate agents occur in research articles in different fields? Subjects or researchers?” and “can inanimate agents be sub-classified according to their nature?” At last, we also desire to identify specific usages of agents

in journal articles. The exploration of these questions, we believe, can help us further understand passive voice in research articles.

THE EXPERIMENT

In order to design the experiment, we firstly conducted a pilot study concerning graduate students' voice use in both general and academic English. To our surprise, we found that among the 6 graduate students participating in the pilot study, half were confused about voice use in general English text while in the test of academic English, all of them chose correct voice forms. These unexpected results made us wonder whether graduate students have more problems with voice choice in general English than that in academic English, as we originally assumed. Therefore, we decided to switch our focus to voice use in general English, practically certain types of verbs, and the subjects of the experiment were also changed to those now taking general English courses, that is, freshmen students.



Verbs Often Confusing Chinese Learners in Voice Use

As indicated in Chapter Two, passive voice can occur only in sentences with transitive verbs since the transformation rule requires the exchange of subject and object positions during the process. Thus, intransitive verbs cannot be passivized as a result of the lack of an object in the active sentence. However, when choosing between active and passive voice, many Chinese learners are often ignorant of this basic concept and generate sentences like, “The event was happened last weekend” or “The phenomenon is appeared in recent years.” These sentences are constructed mainly because of the inanimacy of the subject; in other words, it is considered that “the event” and “the phenomenon” are caused by external forces such as human. The learners fail to realize that verbs like *happen* and *appear* are intransitive, and hence

passivization is impossible. Therefore, transitivity of verbs seem not so self-obvious to Chinese learners.

Another type of verbs that is problematic to Chinese learners when they construct passive voice is ergative verbs. The reason for their misuse is that these verbs can be transitive or intransitive. For example,

[3.8a] Kenny broke the window.

[3.8b] The window was broken by Kenny.

[3.8c] The window broke.

In sentences [3.8a] and [3.8b], the verb “*break*” is used transitively in active and passive voice. In [3.8c], “*the window*” is placed at the subject position without passive transformation, however, and the verb “*break*” functions as an intransitive verb. In other words, the significant characteristic of ergative verbs is to enable the object affected by the transitive verb in active voice (“*the window*” in [3.8a]) to be put at the subject position when the very same verb acts intransitively (Celce-Murcia & Larsen-Freeman, 1999; Palmer, 1988). Levin (1993) describes ergative verbs as follows: “the semantic role of the subject of the intransitive use of the verb is the same as the semantic role of the object of the transitive use of the verb” (1993, p.25).

Following the discussion above on the use of intransitive and ergative verbs, we intend to conduct an experiment in order to investigate if the nature of verbs contributes to Chinese students’ misuse of either active or passive voice.

The Test

Subjects participating in this experiment were freshmen in National Chiao-Tung University who took general English courses. They came from different subject backgrounds, including the five colleges of the university: College of Electrical and

Computer Engineering, College of Computer Science, College of Engineering, College of Biological Science and Technology, and College of Management. The test is composed of 20 sentences extracted from journal articles, Longman Contemporary Dictionary and Collins COBUILD Online Dictionary. Among the 20 test items, 10 sentences contain ergative verbs (*increase, develop, accelerate, focus, fade, change, form, remove, and pass*) and the other 10 contain either intransitive or transitive verbs (*compose, suggest, attribute, appear, comprise, fail, concern, occur, and involve*). For each sentence, students had to choose between active and passive verb form. The criterion to select the 20 sentences is to choose those which should be constructed only in either active or passive voice even without the context. However, when we conducted the test, subjects were only informed that the test was about the choice between active and passive voice, but not of any idea about ergative and intransitive verbs. Students completed the test in 15 minutes.

After the test, we calculated and compared the error rate of the two verb categories and the rate of correct and incorrect answers in each test item. We also further examined wrong voice choice in our data. At last, possible explanations of misuse were explored.

THE MOTIVE OF DESIGNING A LESSON PLAN

In Chapter Four, a lesson plan is proposed because of the following two reasons: firstly, we want to show how our analysis results can be applied to an EAP/EST course. The lesson plan will illustrate how EAP/EST teachers raise graduate students' consciousness about the relationship between voice use and information and theme systems, motivate them to observe the principles governing the two systems and, finally require them to generate a passage conforming to these principles. Secondly, according to the results in the pilot study, we found that graduate students generally

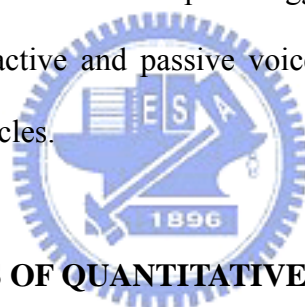
held the view that passive voice should be intensively used in scientific research articles. For example, one graduate student indicated that when sentence subjects are materials, sentences must be constructed in passive voice. Besides, although some graduate students seemingly have a vague idea about maintaining the same theme in one paragraph, they generally do not have the concept that voice choice can be determined by information and theme systems. As a result, the lesson plan is presented in Chapter Four, which is hoped to render some pedagogical implications based on our analysis results.



CHAPTER 4

RESULTS AND DISCUSSION

This chapter is divided into four parts: firstly, the results of the quantitative analysis of voice choice in research articles are presented. Secondly, possible explanations of the quantitative results are given and the relationship between theme and information systems and voice choice is discussed, as shown by the results from qualitative analysis. Next, the results of the experiment about identifying commonly-misused verbs in constructing active and passive sentences are presented. The discussion will be further divided into ergative verbs and transitive/intransitive verbs. Finally, we will provide a lesson plan suggesting how to teach graduate students to choose between active and passive voice according to information and theme systems in research articles.



RESULTS OF QUANTITATIVE ANALYSIS

The quantitative study includes the following: (1) the occurrences of active and passive voice in both journals, (2) the occurrences of agentless and expressed agents in passive sentences and (3) the occurrences of animate and inanimate agents as well as their functions.

The Occurrences of Active and Passive Voice

In five-sixths of the sample texts in *JMS*, over half of the verbs (50%) are written in passive. Among them, the highest rate is up to 88.5% in Text 3a. The lowest rate is 23.8% in Text 7a. In contrast, in *ESP*, in only two texts, that is, one-twelfth of all sample texts, passive verbs constitute more than 50% of all verbs. In addition, in four texts, passive voice is used in less than 20% of the verbs. Table 4.1 and 4.2 show the

percentages of passive and active verbs in each sample text in *JMS* and *ESP* respectively.

Table 4.1 Percentages of passive vs. active verbs in *JMS* sample texts

Text no.	Total verbs	Passive verbs	Active verbs
Text 1a	13	8 (61.54%)	5 (38.46%)
Text 2a	22	16 (72.73%)	6 (27.27%)
Text 3a	26	23 (88.46%)	3 (11.54%)
Text 4a	98	48 (48.98%)	50 (51.02%)
Text 5a	28	16 (57.14%)	12 (42.86%)
Text 6a	42	25 (59.52%)	17 (40.48%)
Text 7a	63	15 (23.81%)	48 (76.19%)
Text 8a	18	12 (66.67%)	6 (33.33%)
Text 9a	19	8 (42.11%)	11 (57.89%)
Text 10a	44	33 (75.00%)	11 (25.00%)
Text 11a	54	31 (57.41%)	23 (42.59%)
Text 12a	20	12 (60.00%)	8 (40.00%)
Text 13a	21	15 (71.43%)	6 (28.57%)
Text 14a	25	16 (64.00%)	9 (36.00%)
Text 15a	36	24 (66.67%)	12 (33.33%)
Text 16a	42	24 (57.14%)	18 (42.86%)
Text 17a	65	41 (63.08%)	24 (36.92%)
Text 18a	21	14 (66.67%)	7 (33.33%)
Text 19a	30	20 (66.67%)	10 (33.33%)
Text 20a	33	16 (48.48%)	17 (51.52%)
Text 21a	21	14 (66.67%)	7 (33.33%)
Text 22a	15	11 (73.33%)	4 (26.67%)
Text 23a	12	9 (75.00%)	3 (25.00%)
Text 24a	34	22 (64.71%)	12 (35.29%)
Total	802 (100%)	473 (58.98%)	329 (41.02%)

Table 4.2 Percentages of passive vs. active verbs in *ESP* sample texts

Text no.	Total verbs	Passive verbs	Active verbs
Text 1b	129	50 (38.76%)	79 (61.24%)
Text 2b	354	103 (29.10%)	251 (70.90%)
Text 3b	71	28 (39.44%)	43 (60.56%)
Text 4b	39	16 (41.03%)	23 (58.97%)
Text 5b	119	27 (22.69%)	92 (77.31%)
Text 6b	28	10 (35.71%)	18 (64.29%)
Text 7b	191	73 (38.22%)	118 (61.78%)
Text 8b	119	23 (19.38%)	96 (80.67%)
Text 9b	136	26 (19.12%)	110 (80.88%)
Text 10b	43	10 (23.26%)	33 (76.74%)
Text 11b	203	56 (27.59%)	147 (72.41%)
Text 12b	67	31 (46.27%)	36 (53.73%)
Text 13b	39	7 (17.95%)	32 (82.05%)
Text 14b	89	27 (30.34%)	62 (69.66%)
Text 15b	60	22 (36.67%)	38 (63.33%)
Text 16b	45	18 (40.00%)	27 (60.00%)
Text 17b	98	39 (39.80%)	59 (60.20%)
Text 18b	15	5 (33.33%)	10 (66.67%)
Text 19b	30	13 (43.33%)	17 (56.67%)
Text 20b	29	18 (62.07%)	11 (37.93%)
Text 21b	39	19 (48.72%)	20 (51.28%)
Text 22b	164	43 (26.22%)	121 (73.78%)
Text 23b	134	26 (19.40%)	108 (80.60%)
Text 24b	25	14 (56.00%)	11 (44.00%)
Total	2266	704 (31.07%)	1562 (68.93%)

The average occurrences of active and passive voice in the Methods section of research articles in both journals are illustrated in Table 4.3. Over half of the verbs (58.98%) in *JMS* are written in passive voice, while in *ESP* passives constitute only 31.07%.

Table 4.3 Average occurrences of active and passive verbs

	<i>JMS</i>	<i>ESP</i>
Active voice	329 (41.02%)	1562 (68.93%)
Passive voice	473 (58.98%)	704 (31.07%)
Total	802 (100.0%)	2266 (100.0%)

As indicated in Table 4.3, the use of passive voice in *JMS* (58.98%) is higher than that in *ESP*. The result conforms to the general idea that passive voice is used more frequently in hard science than in soft science. Further examination of the discourse contexts of all active and passive usages reveals three possible reasons, which will be explicated later.

The Occurrences of Agentless and Expressed Agents in Passive Voice

As shown in Table 4.4, most passive constructions are presented in agentless form. Agentless passives constitute 73.15% and 86.36% of all passive constructions in *JMS* and *ESP* respectively. We generalize three possible reasons: (1) the agents are the writers or researchers, who are already known to readers and thus omitted; (2) the writers intend to detach themselves from the investigative procedure; and (3) the writers intend to defocus on the agents; in other words, the agents are considered unimportant. The followings are examples in the data:

[4.1] Several important conditions should be met in the SSPG experiment. (Text 4a)

[4.2] Frequencies of these three types of headings will be reported. (Text 5b)

Table 4.4 Expressed agents and agentless passive constructions

	<i>JMS</i>	<i>ESP</i>	Total
Expressed agents	127 (26.85%)	96 (13.64%)	223
Agentless	346 (73.15%)	608 (86.36%)	954
Total	473 (100.0%)	704 (100.0%)	1177

The Analysis of Expressed Agents in *JMS* and *ESP*

Table 4.5 indicates the results of further analysis of expressed agents into animate and inanimate agents. In *JMS*, there are 3 (2.36%) animate and 124 (97.64%) inanimate agents. In *ESP*, there are 52 (54.17%) animate and 44 (45.83%) inanimate agents. It can be observed that in *JMS* inanimate agents are the overwhelming majority, while in *ESP*, there are more animate than inanimate agents.

Table 4.5 Animate/inanimate agents in the data

	<i>JMS</i>	<i>ESP</i>
Animate agents	3 (2.36%)	52 (54.17%)
Inanimate agents	124 (97.64%)	44 (45.83%)
Total	127 (100.0%)	96 (100.0%)

We also found that the 3 occurrences of animate agent in *JMS* all refer to the researchers or the manufacturers of experimental equipment as indicated in

[4.3]-[4.5].

[4.3] Raman peak position of the Si device layers and the Si-Si phonon mode peak positions of the underlying $\text{Si}_{1-x}\text{Ge}_x$ virtual substrate presented in this paper were obtained from the original experimental spectrum with a Gauss-Lorentz function fitting using the software provided by the equipment manufacturer. (Text 13a)

[4.4] The Ba/Ti molar ratio provided by the manufacturer was 0.998. (Text 16a)

[4.5] $\text{Cd}_{1-x}\text{Zn}_x\text{Te}$ films were prepared on a simultaneous evaporation system DM-400, which was designed by ourselves. (Text 23a)

However, the animate agents in *ESP* could be classified into four sub-categories: subjects, researchers/informants, authors in related studies, and others, as indicated in Table 4.6. Examples are shown in [4.6]- [4.9].

[4.6] Subjects

This lecture was attended by 40 students. (Text 3b)

[4.7] Researchers

Data at all sites were collected separately by the three researchers, and at MSU this collection was aided by a research assistant. (Text 11b)

[4.8] Authors in related studies

He is thus in the inverse position to the typical ESP teacher plotted by Hutchinson and Waters (1987). (Text 10b)

[4.9] Others

Negative face reflects the desire for independence, to be able to act freely and unimpeded by others. (Text 21b)

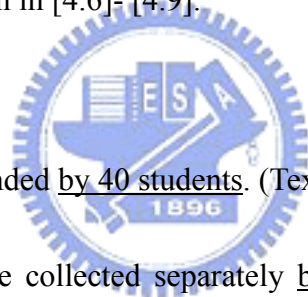


Table 4.6 Sub-categories of animate agents in *ESP*

	Subjects	Researchers/ Informants	Authors in related studies	Others	Total
Animate agents	21 (40.38%)	13 (25.00%)	13 (25.00%)	5 (9.62%)	52 (100%)

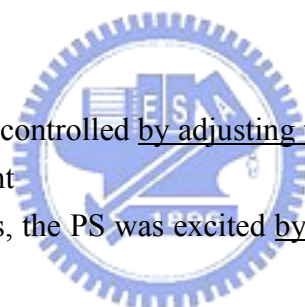
Inanimate agents could also be classified into sub-categories. In *JMS*, they were methods or materials/equipment as shown in Table 4.7. Examples are as follows:

[4.10] Methods

The temperature was controlled by adjusting the heating power. (Text 11a)

[4.11] Materials/Equipment

For PL measurements, the PS was excited by a He-Ne laser (632.8nm). (Text 8a)



It can be noted that these inanimate agents are materials, equipment, and methods, which are “activators” of research activities. Their presence as expressed inanimate agents thus reflects their important role in scientific research. They also act as a means for the writers to focus on the research process.

Table 4.7 Sub-categories of inanimate agents in *JMS*

	Methods	Equipment	Total
Inanimate agents	70 (56.45%)	54 (43.55%)	124 (100%)

Inanimate agents in *ESP* (Table 4.8) have slightly different sub-categories from those in *JMS*. In addition to methods and materials, there is one more category—potential factors/variables influencing results. For example,

[4.12] Methods

This emotional turn is conveyed by the transfer of the adjective from post-modifying to pre-modifying position. (Text 18b)

[4.13] Materials

The final corpus in English is constituted by 80 abstracts belonging to four different journals in the area of experimental social sciences. (Text 12b)

[4.14] Potential factors/variables

The selection of texts proposed in this study was expected to allow the observation not only of regularities in the different sections of experimental RAs across the disciplines represented in the corpus but also of differences that might be determined by the type of science. (Text 23b)

Table 4.8 Sub-categories of inanimate agents in *ESP*

	Methods	Materials	Factors/Variables	Total
Inanimate	20	17	7	44
agents	(45.45%)	(38.64%)	(15.91%)	(100%)

We summarize the occurrences of *by*-agents in passive constructions in both *JMS* and *ESP* in Figure 4.1. The functions of *by*-agents are specified in the sub-categories of animate and inanimate agents.

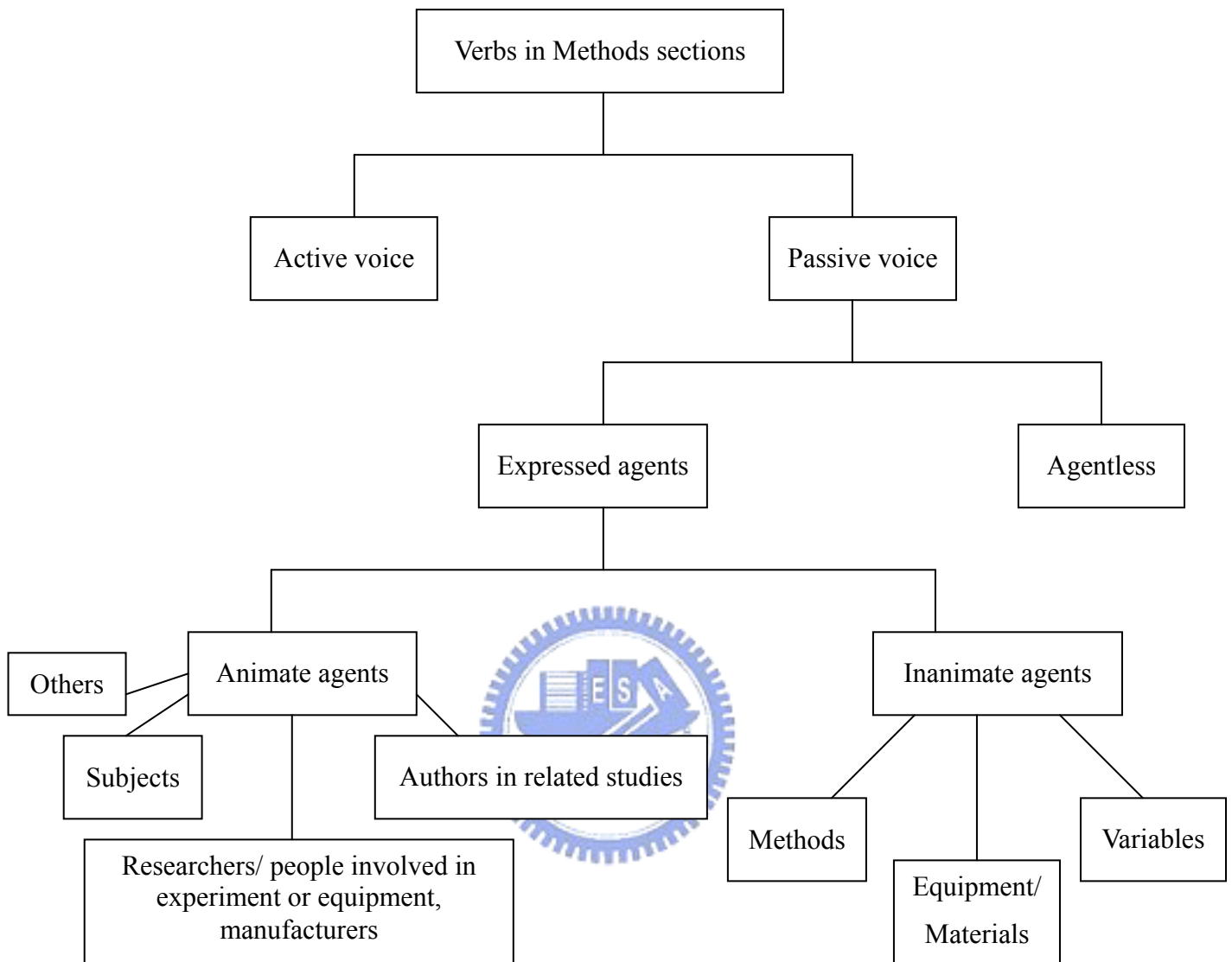


Figure 4.1 The categories and sub-categories of *by*-agents in Methods section

RESULTS OF QUALITATIVE ANALYSIS

The findings of the analysis above indicate that although there are shared writing conventions across different disciplines in the academic discourse community, unique practice in the choice of active/passive voice may characterize hard and soft science. For example, passive voice is generally believed to be a technique for researchers to reduce human involvement in research articles. The choice between active and passive

voice in hard and soft science as shown in the quantitative analysis reveals different patterns. We, therefore, conducted qualitative analysis in order to learn (1) possible explanations for the results of the quantitative analysis; (2) whether factors other than objectivity contribute to voice choice in research articles. We examined the contexts where passives or actives occur and compare them, especially in relation to the theme and the information system of text, as mentioned earlier.

Voice Use in *JMS*

In *JMS*, the extensive use of passive voice in the Methods section (58.98%) reflects the general concept that objectivity is paramount in describing the research methodology and the experimental process. This can be verified from three findings in our examination of the nature of agents in passive voice structure. Firstly, only 3 occurrences (2.36%) of animate agent were found in all *by*-agents. Secondly, there are a large number of occurrences of agentless passives (73.15%); this suggests writers might try to focus on the research per se. Finally, when *by*-agents are used, they are inanimate agents shown as “methods” and “equipment/materials,” indicating the means employed in research to detail the experimental procedure in order to increase the validity of research.

Voice Use in *ESP*

In contrast to *JMS*, *ESP* has more active than passive constructions (68.93% to 31.07%). Further examining the content of the sample texts, we found that there may be three possible reasons for this: firstly, unlike hard science in which inanimate materials, equipment, model, etc. usually play essential roles, soft science often has people as subjects, who are able to “actively” perform actions. For example:

[4.15] ...the native-speaking US students at MSU and the Catalans at UHC share characteristics that separate them from the US immigrants.... The first two groups present the traditional profiles of public university undergraduates in their countries.... If members of either group were to study at the others' institution, they would be visa students. On the other hand, the immigrant students at UCC receive a lesser degree, the *Associates*, upon graduation.... They belong to a minority ethnic group; they come from lower social-class backgrounds...; and they have inferior secondly education in their home countries and in the USA. (Text 11b)

[4.16] In this research the sampled students are in their early twenties and come from the degree of 'Business', 'Chemical Engineering', 'English Philology' and 'Telecommunications'. They are representative of Spanish university undergraduates studying many subjects, with lectures and exams for each....On average, they have studied English for at least 5 years before entering university. (Text 1b)

In [4.15] and [4.16], subjects under investigation take the position of the sentence subject and, at the same time, active voice is applied. This suggests the extensive use of active voice is mainly due to the fact that animate subjects are used more often in the descriptions of research method in soft science.

The second explanation is that writers in the field of social science usually describe how they conduct their investigation as if they were addressing the readers. Followings are passages from our data:

[4.17] We chose, in our present study, to observe and videotape students' beside performance in ward teaching, as we felt that this approach would offer the most direct, reliable, and rapid access to the kinds of problems with which we were concerned. For our purposes, we defined students' needs or problems as "elements of competent academic.... Specifically, we focused on those language errors that caused communication problems., we consulted clinical training textbooks for information on how to interview patients,.... We recorded six ward-teaching sessions over a period of three months....(Text

24b)

[4.18] ..., I reviewed several inventories of questions and found Christensen's typology the most appropriate.... I supplemented it with several categories of particular relevance to second language teaching situations. Table 1 shows the typology I employed, along with examples from my database.... In the transcripts, I then identified all of the case leaders' questions and classified them using the typology. On the code sheet, I also indicated whether each question was open-ended or closed, according to the definitions shown in Table 2. (Text 16b)

In [4.17], writers adopt *We*-structure to justify and explain their research method while in [4.18], sentences are even initiated with *I* to describe the research process. The use of first-person pronouns, therefore, contributes to the choice of active voice.

Finally, in addition to the involvement of researchers and test-takers in the Methods section, informants' or experts' perspectives are often brought up in the field of social science in order to present the theoretical background of the present study or to show the methodological significance of the present study by indicating support from these informants or experts. For example:

[4.19] Bhatia (1993) has the most complete discussion of letters of application as a genre. He found a six-part structure in his study of letters of application for academic positions at universities.... Further, Bhatia noted that inadequate textualizations in the application letter could lead to failing to get short-listed for a job. ...Bhatia pointed out that a significant difference between South-Asian application letters.... (Text 21b)

In [4.19], in order to justify their own research, the writers put Bhatia, the well-known researchers in genre study, in the subject position to introduce Bhatia's claims in four sentences. Active voice is naturally applied.

As indicated above, we found that the extensive use of active voice in the research articles of social science can be attributed to the animate nature of sentence

subjects, and their practical function to facilitate communication with readers and to render support to the authors' propositions.

Potential Factors of Voice Choice

The qualitative analysis also reveals that objectivity is not the only reason why researchers choose to encode sentences in passive voice rather than active voice.

Theme and information systems seem to be involved. For example,

[4.20] High purity powders of BaCO₃ (>99.5%), ND₂O₃ (>99.5%), ZnO (>99.95%) and M₂O₅ (M = Nb, Ta) (>99.9%) were weighted to Ba₅NdZnM₉O₃₀ (M = Nb, Ta) stoichiometry. The compounds with M as Nb and Ta will be referred to as BNZN and BNZT, respectively in the remaining part of the text. The powders were ground in agate mortar to obtain homogeneous mixtures and calcined in 1350 and 1450 °C for 48h for BNZN and BNZT, respectively. The calcined powders were reground into very fine powders and palletized into disks of 11 mm diameter and about 2-4 mm thickness using a cold isostatic press with a pressure of 200 MPa. (Text 2a)

[4.21] The data for this study comprise the Results, Discussion and other following sections of 20 RAs that report empirical research. These articles form part of a corpus of 40 RAs (the remaining RAs did not report empirical studies). The 40 articles had been selected on a stratified random basis (10 RAs per journal were chosen, following reference to a table of random numbers) from four established journals of applied linguistics. (Text 5b)

In examples [4.20] and [4.21], note that “*the powders*” and “*articles*” are used as grammatical subjects in a string of sentences since they are the theme foci in each paragraph, and therefore fronted to the subject position. The use of voice, as shown in each example, is influenced by the theme system.

In some other cases, the information system, that is, the given-to-new principle seems to govern voice choice. For example,

[4.22] For the electric test, raw samples were conformed into disk pellets and then fired at 1000 °C for 48h, 1150 °C for 100h, 1300 °C for 24h and 1400 °C for 10h. The palletized samples were electroded onto both surfaces with silver high-conductivity paste. These contacts were fired at 300 °C for 5 h. (Text 3a)

[4.23] The survey was distributed in 1998 to employers of Monash graduates with business degrees (Bachelor of Commerce and Bachelor of Business). The relevant employer companies were derived from university graduate destination survey data, and from the list of companies that attend Monash for careers fairs. Out of a pool of 96 relevant companies, 24 completed the survey. (Text 20b)

Example [4.22] above introduced how the samples were handled step by step: the first sentence described how the raw samples (given information) were conformed into “*disk pellets*” (new information). Then, in the next sentence, these “*palletized samples*” appeared as given information to introduce the next step (“*The palletized samples were electroded...*”). Likewise, the first sentence in example [4.23] presents “*employers*” as new information. Then, in the second sentence this new information, being transformed into a noun phrase (“*employer companies*”), becomes given information and the grammatical subject of the sentence to elicit the companies qualified in the experiment (new information), and “24” (of these companies) becomes the given information in the next sentence.

Since theme and information systems play important roles in the determination of subjects and voice choice, two questions worth discussing. Firstly, are there any principles governing the application of either theme or information system when writers choose subjects of sentences? Secondly, if there are principles, can they be applied to research articles in both hard as well as soft science? As the use of the same subject in two or more successive sentences can develop subject continuity, writers

often use unmarked theme, that is, combining theme with the grammatical subject, to create a focus in a paragraph or a number of paragraphs. In our analysis of *JMS*, we found that theme system is usually applied in presenting the method, describing the materials or equipment, like “*powders*” in example [4.20]. In *ESP*, the paragraphs describing the characteristics of subjects or texts for analysis are also governed by theme system. On the other hand, the given-to-new principle of information system usually governs the string of sentences depicting the experimental procedures in both *JMS* and *ESP*, like examples [4.22] and [4.23]. Thus, we may generalize that theme system is applied in order to focus on one particular theme while the use of information system is often aimed to describe the procedure of investigation.

Functions of *By*-Agents

With respect to *by*-agents, we may interpret the results from a functional perspective. Firstly, *by*-agents are normally considered as the contributors of actions. Nevertheless, in the study, we noted that *by*-agents used in research articles have other functions. *By*-agents can act as a way to explain experimental variables, methods and equipment like “*by the type of science,*” “*by adjusting the heating power*” and “*by a He-Ne laser.*” Secondly, the functions of *by*-agents in research articles of different natures across disciplines may be different. In the study, most expressed agents in *JMS* are inanimate agents (97.64%) which serve to illustrate the method and equipment used in the study. In *ESP*, however, over half of them (54.17%) are animate agents. They are often aimed to show subjects’ and researchers’ performance during the investigation or justify research results by mentioning others’ research outcomes. The functions and patterns of *by*-agents are summarized in Table 4.9.

Table 4.9 Functions and patterns of *by*-agents

	Functions of <i>by</i> -agents	Patterns of <i>by</i> -agents
Animate agents	Subjects	
	Researchers	<i>by</i> + noun (s)/noun phrase (s)
	Writers reviewing literature	
	Others	
Inanimate agents	Materials	
	Equipment	<i>by</i> + noun (s)/noun phrase (s)
	Factors	
	Methods	<i>by</i> + Ving <i>by</i> means of + noun (s)/noun phrase (s)

Besides, *by* in the pattern “*by* + Ving” is often omitted. For example,

[4.24] The key and termination choices were identified and interpreted within the systems given in Brazil’s model and transcribed using those conventions.
(Text 4b)

[4.25] The density of sintered pellets were measured with the Archimedes method and calculated using the following equation $\rho = W_{\text{air}} / (W_{\text{air}} - W_{\text{aqu}})$.
(Text 6a)

According to our analysis, the omission of *by* in the “*by* + Ving” is extensively used in the genre of journal articles although other types of writing seem not to apply this *by*-omission pattern.

VERBS OFTEN CONFUSING CHINESE LEARNERS

As indicated in Chapter Three, in order to understand whether the nature of a verb itself in a sentence can influence voice choice by nonnative writers, we conducted a simple experiment. We chose 10 ergative and 10 transitive/intransitive verbs to construct 20 sentences. In each test item, students were asked to choose between active and passive voice according to its sentence context. However, after the analysis, we found out that 68.97% of the students chose the passive form of “*comprise*” and formed the sentence “The model is comprised of about 13000 four-node quadrature elements.” Since the use of passive form of “*comprise*” in this sentence is informal, we exclude this test item. Thus, there are 2204 answers in total (116 subjects answer 19 items). The numbers of both correct and incorrect answers are 1408 and 796, respectively. On average, there is an error rate of 36.12% for each subject and of 36.16% for each test item. Detailed data about the verbs, the numbers of correct and incorrect answers in all test items are shown in Table 4.10.

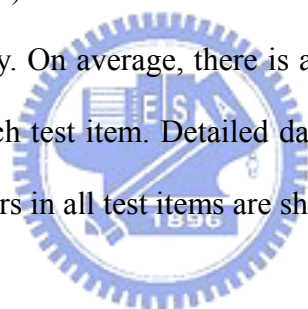


Table 4.10 Verbs in the test items, and rates of correct and incorrect answers

Item no.	Verbs	Correct answers	Incorrect answers	Total
1	increase*	96 (82.76%)	20 (17.24%)	
2	compose	103 (88.79%)	13 (11.21%)	
3	develop*	47 (40.52%)	69 (59.48%)	
4	suggest	96 (82.76%)	20 (17.24%)	
5	attribute	66 (56.90%)	50 (43.10%)	
6	accelerate*	51 (43.97%)	65 (56.03%)	
7	appear	73 (62.93%)	43 (37.07%)	
8	comprise	36 (31.03%)	80 (68.97%)	
9	involve	102 (87.93%)	14 (12.07%)	
10	fail	82 (70.69%)	34 (29.31%)	
11	focus*	85 (73.28%)	31 (26.72%)	116
12	concern	57 (49.14%)	59 (50.82%)	(100%)
13	fade*	63 (54.31%)	53 (45.69%)	
14	develop*	88 (75.87%)	28 (24.14%)	
15	change*	62 (53.45%)	54 (46.55%)	
16	form*	33 (28.45%)	83 (71.55%)	
17	remove*	100 (86.21%)	16 (13.79%)	
18	pass on*	43 (37.07%)	73 (62.93%)	
19	occur	82 (70.69%)	34 (29.31%)	
20	involve	78 (67.24%)	38 (32.76%)	
Total (Excluding Item #8)		1408	796	

Note: Verbs with * are ergative while others are transitive or intransitive.

Analyses were also conducted in the group of test items containing ergative verbs, and in the group of test items containing transitive or intransitive verbs. The results are presented later respectively.

Ergative Verbs in the Test

As indicated above, the low error rates of item #7 and #19 reflect Chinese learners may have acquired the ability to correctly use intransitive verbs. Nevertheless, when we switched our focus to the verbs which can be both transitive and intransitive in our test, the results conform to our assumption that transitivity may be the major factor of the students' misuse in voice. The error rates of item #16 (*form*), #18 (*pass on*), #3 (*develop*) and #6 (*accelerate*) are all over 50%: 71.55%, 62.93%, 59.48% and 56.03%, respectively. The test items are as follows:

[4.26] In certain instances, the deposits form on machine surfaces at the exact location where the oil has degraded, for example, hot surface coking. (item #16)

[4.27] Many people have accepted that theory and believed that cancer is passed on entirely through heredity. (item #18)

[4.28] Knowledge in the field of genetics has been developing very rapidly. (item #3)

[4.29] This trend will accelerate when companies move beyond the wired centers to offer learning in remote regions and around the world. (item #6)

We propose three possible explanations for high error rates of these four verbs. The first one is the use of inanimate agents as sentence subjects. Most Chinese learners tend to consider using passive voice when sentence subjects are inanimate. Therefore, active voice for verbs like “*form*,” “*develop*” and “*accelerate*,” in their opinion, are not possible for sentences with inanimate subjects like “*deposits*,” “*cancer*,” “*knowledge*,” and “*trend*.” In item #1, for example, only 28.45% of the students

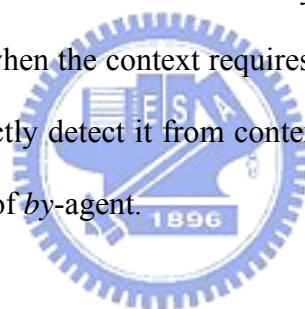
correctly chose the active construction of “*form*” while others mistakenly assumed the deposits cannot grow automatically on machine surfaces without any human intervention. The same reason many stand for item #3 and item #6. Nearly 60% of the students selected “*has been developed*” instead of “*has been developing*” to describe the growth of knowledge. Also, 56.03% of them incorrectly chose the passive form of “*accelerate*.”

The second possible reason of the students’ misuse is the absence of *by*-agents. In our test, all *by*-agents are omitted. In sentences, especially those with ergative verbs, students may be confused about the choice active and passive voice. The absence of *by*-agents may then lead them to the choice of active voice. In item #18, for instance, most students mistakenly used the active form. Merely 37.07% students correctly constructed the sentence as “*Many people have accepted that theory and believed that cancer is passed on entirely through heredity.*”

The third one is students’ unclear idea about the use of ergative verbs. As indicated before, the main feature of ergative verbs is that they can be used both transitively and intransitively. However, how can one choose between these two? In fact, the key lies in context. “*Form*” in item #16 is used intransitively and means “something starts to exist” to be compatible with the sentence subject—“*deposits*.” Likewise, “*accelerate*” in item #6 has an intransitive meaning: “something moves faster than usual” to be compatible with the subject “*trend*.” Thus, we suggest although both transitive and intransitive uses are possible for ergative verbs, learners have to choose the more appropriate one according to the context. The same idea is true to “*develop*” in item #3—both transitive and intransitive uses are possible when it means “to grow or increase” while the context requires active voice to be used. Nevertheless, in contrast to item #3, item #14 (*A number of products have been developed which are permeable to air and water.*) is a sentence in which “*develop*”

should be used in passive form because here it indicates “to invent something,” which can be used only transitively and the active usage requires animate agents. Thus, the application of active voice in this sentence may make it semantically unacceptable.

Although these three possible factors of voice misuse are discussed, inanimate subjects, the absence of *by*-agents and the use of ergative verbs, is presented individually, we think they are closely related to each other. For example, the high error rate of “*form*” in item #16 is due to its inanimate subject “*the deposits*,” and it, in turn, may also be attributed to an unclear idea about its intransitive use. Similarly, the experimental results showed not only that the inanimate sentence subjects “*knowledge*” and “*trend*” in item #3 and item #6, respectively, directly influenced the students’ voice choice but also that most students may not have a clear concept about ergative verbs. At last, even when the context requires passive form in item #18, most students are not able to correctly detect it from context and mistakenly choose active voice because of the absence of *by*-agent.



Transitive/Intransitive Verbs in the Test

Among the 10 items containing transitive/intransitive verbs, only two verbs, “*comprise*” (item #8) and “*concern*” (item #12), have an error rate above 50%. As indicated in 4.3, we will not discuss item #8, “*comprise*,” because of the informal usage of “*be comprised of*” may have the same meaning as “*comprise*.”

In item #12, half of our students (50.82%) incorrectly constructed the sentence “**These problems are concerned all of us*.” This result may be attributed to the different usages of “*concern*” as verb and adjective. “*Concern*,” when acting as a verb, has the following three meanings: (1) to be important to, (2) to be about, and (3) to worry, and all of them are used transitively. (Item #12 applies the first meaning) However, when “*concerned*” functions as an adjective, particles are usually added,

such as “*be concerned about*” (meaning to be worried), “*be concerned in*” (meaning to take part) and “*be concerned with*” (meaning to be about). Therefore, it is possible that the different usages of “*concern*” as verb and adjective are confusing to Chinese students. On the one hand, they are more familiar with the adjective form “*concerned*.” On the other hand, they may fail to realize that “*concern*” as a verb is transitive and thus, mistakenly considered the sentence should be constructed in passive voice.

During the design of the test, we thought that transitivity may be the major problem when subjects choose between either active or passive voice. Thus, we expected that over half of the students may choose passive voice in item #7 (*appear*) and #19 (*occur*). However, the results show that the error rates of these two items are low, only 37.07% and 29.31%, respectively. Therefore, it seems to suggest that Chinese learners are aware of the fact that it is not possible to passivize intransitive verbs because of their lack of objects. These mixed results suggest that the misuse of either active or passive voice seems to result from subjects’ failure to perceive the relationship between the subject and the verb according to the context.

So far, we discuss the results from our experiment of verbs which may confuse Chinese students in voice choice. Results for the group ergative verbs reveal that students may be confused with verbs which can be used both transitively and intransitively. Three possible reasons are indicated for students’ voice misuse of ergative verbs. Although the results for the group of transitive/intransitive verbs may seem mixed, suggesting that there may be other variables involved in student’ voice choice.

Then, we will turn to the pedagogical application of our research results. In other words, we will propose how to teach voice, with particular focus on voice use at the discourse level, in relation to information and theme systems.

PEDAGOGICAL APPLICATION OF RESEARCH RESULTS

As indicated in Chapter One, one of the purposes of the present study was to provide pedagogical implications for teaching voice on the basis of our research results. One of our findings shows that voice use is closely related to discourse organization, such as theme and information systems. The conformation to these two systems can improve text cohesion and, in turn, promote effective communication. Thus, a lesson plan is designed for the following two reasons. Firstly, we hope graduate students can no longer be confined to the idea that passive voice is used because research articles should be objective. Instead, voice use may be a writing strategy to improve cohesion and coherence of text. In other words, writers choose appropriate voice according to the rhetorical structure of the text, which, in the case of the methods section of research articles, often either focuses on a particular device or material in the study, or on an experimental process. On the other hand, it is also desired to provide EAP/EST teachers an idea about how to teach graduate students voice use in research articles in context.

Lesson Plan

There are three stages in the lesson plan: Stage 1 is text analysis for consciousness-raising. Stage 2 gives an introduction to theme and information systems. Stage 3 provides writing task for practice. The lesson plan is designed as follows.

Lesson Plan: Passive Voice in Research Articles

Purpose

The lesson plan is aimed to teach graduate students how to choose appropriate voice

in the Methods section of the research article by following the patterns of information and theme systems in text.

Stage 1 Text Analysis for Consciousness-raising

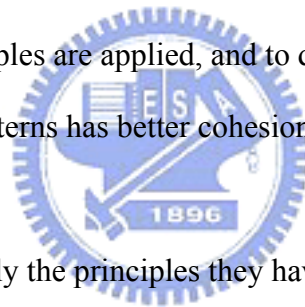
In this stage, Sheets A and B are issued. Students discuss in group to determine which text is better and explain their choice.

Stage 2 Introduction to Theme and Information Systems

After the group discussion in the first stage, the concepts of theme and information systems are introduced. The principles governing the two systems in relation to text cohesion are explained. In other words, information system is usually applied to describe the procedure of experiment while theme system is used to create a focus on a particular topic. Then, students are required to read the passages again, underlining the sentences that these principles are applied, and to discuss in group whether the passage conforming to the patterns has better cohesion and coherence.

Stage 3 Writing Practice

In this last stage, students apply the principles they have learned in Stage 2 to complete a passage, as shown in Sheet C, by reading the figure provided.



Vertical Electrode GaN-Based Light-Emitting Diode Fabricated by Selective Wet Etching Technique
(theme + information systems)

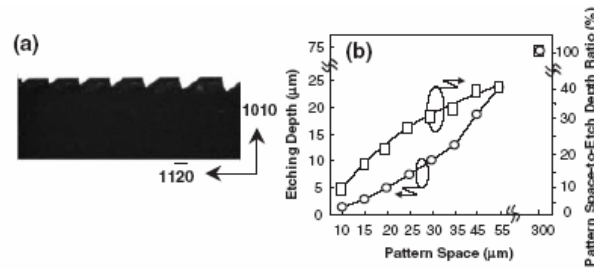


Fig. 1. (a) Cross-sectional SEM image and (b) relationship between pattern space width and etching depth for the wet-etched sapphire substrate.

A 430- μm -thick (0001)-oriented sapphire substrate and line & space pattern were used in the wet etching test. **The sapphire substrate was wet etched using a H_3PO_4 -based solution.** The etching rate could be increased more than 1 $\mu\text{m}/\text{minute}$ depending on the H_3PO_4 composition and etching temperature. **This etching rate is sufficiently high to etch even a thick sapphire substrate and is comparable to the LLO process time.**

Figure 1(a) and 1(b) show a cross-sectional scanning electron microscope (SEM) image of the wet etched-sapphire substrate and the relationship between the pattern space width and the etching depth, respectively. **The etched structures are all V-grooves. This V-shape structure can be used to form a cleaving line to break the sapphire substrate.** Our recent study showed that a 100- μm -thick sapphire substrate can be cleaved by forming a wet etching line of 3 μm depth. It is anticipated that this method will be very effective for decreasing chip cost and increasing productivity.

The etching depth is substantially dependent on the pattern space width, as shown in Fig. 1 (b). This means that **if the pattern space width is narrower than the etching target thickness**, wet etching will self-stop before reaching the target thickness.

Vertical Electrode GaN-Based Light-Emitting Diode Fabricated by Selective Wet Etching Technique
(theme + information systems)

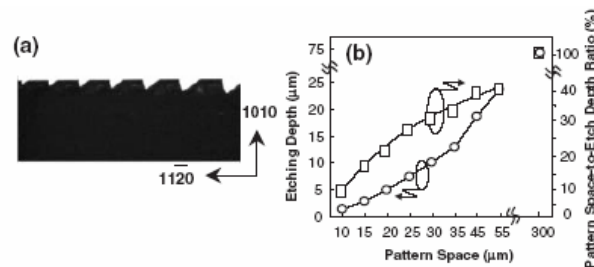


Fig. 1. (a) Cross-sectional SEM image and (b) relationship between pattern space width and etching depth for the wet-etched sapphire substrate.

A 430- μm -thick (0001)-oriented sapphire substrate and line & space pattern were used in the wet etching test. **We wet etched the sapphire substrate, using a H_3PO_4 -based solution.** The etching rate could be increased more than 1 $\mu\text{m}/\text{minute}$ depending on the H_3PO_4 composition and etching temperature. **Even a thick sapphire substrate can be etched by such a high etching rate, which is comparable to the LLO process time.**

Figure 1(a) and 1(b) show a cross-sectional scanning electron microscope (SEM) image of the wet etched-sapphire substrate and the relationship between the pattern space width and the etching depth, respectively. **The etched structures are all V-grooves. A cleaving line can be formed, using this V-shape structure, to break the sapphire substrate.** Our recent study showed that **we can cleave 100- μm -thick sapphire substrate by forming a wet etching line of 3 μm depth.** It is anticipated that this method will be very effective for decreasing chip cost and increasing productivity.

The pattern space width is substantially dependent on the etching depth, as shown in Fig. 1 (b). This means that **if the etching target thickness is wider than the pattern space width -**, wet etching will self-stop before reaching the target thickness.

Mechanical Stability of Externally Deformed Indium-Tin-Oxide Films on Polymer Substrates

All of the test vehicles (OLD) used in the experiments included ITO films of 45-50 Ω /sq. sheet resistance (NEW) and about 100 nm thickness. As shown in Fig 1(b), the ITO films (OLD) on polycarbonate substrates were patterned to form island arrays (NEW) of $200 \times 100 \mu\text{m}^2$ size and 30/300 μm (vertical/horizontal) spacing, and Al films were sequentially deposited (NEW). The deposited Al films (OLD) were also patterned as pad-electrodes for accurate resistance measurement (NEW). All of the measurements (OLD) concerned with electrical characteristics were conducted by the four-point probe method (NEW) in a probe station using ITO islands at the midpoint of the gauge.

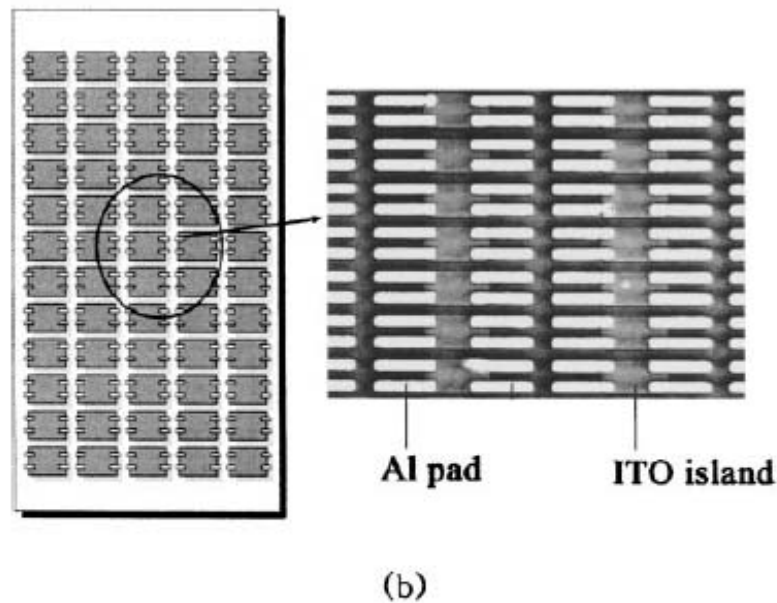


Fig. 1. (a) Schematic view of experimental setup of mechanical testing, and (b) patterned ITO islands including Al pad-electrodes; left panel, schematic view of whole test vehicle; right panel, photograph of magnified test vehicle.

The two passages in Sheets A and B describe the same experimental process but are constructed differently. The former follows the patterns of theme and information systems while the latter does not. The first stage is designed to raise students' consciousness about how discourse organization may influence text cohesion. After student discussion, the teacher explains how sentences are related to each other to achieve text cohesion.

In the second stage, the teacher explains the concepts of information and theme systems as well as the principles governing them in the Methods section of research articles. Students are then asked students to reread the passages and identify the given/new information and the theme/rheme in the better passage. It is then shown how voice choice is related to either of the two systems. Explicit illustration is critical to help students realize such relation. This also acts as a warm-up for the writing task in the next stage.

In the last stage, we design a task requiring students to complete a cohesive passage in the Methods section by applying the principles they learn. Sheet C is used. In the passage, the underlined sentences or phrases present the old/new information (as marked on Sheet C) and the phrases in grey will be left blank for students to fill in. Before giving the task, the teacher should make sure students understand the purpose of the exercise. Besides, teachers can first guide students by asking them which system they think should be used in the passage. If they cannot decide, teachers can review the principles again. This process is aimed to enhance their understanding of theme and information systems.

In the lesson plan, we use research articles in the field of materials science as the materials for the task. However, research articles from other fields can also be used for a lesson plan for students in those fields. EAP/EST teachers can vary the materials according to students' academic backgrounds. Besides, although we only demonstrate

the given-to-new pattern in the third part of the lesson plan, teachers can choose passages with theme system for practice. This lesson plan can be expanded in many ways. For example, the task may be even more challenging by asking students to choose a paper that they recently read and to analyze its discourse organization in relation to voice use. Students may also be encouraged to rewrite passages not following the principles of theme and information systems into better structured ones by changing the voice of sentences.



CHAPTER 5

CONCLUSIONS

The present study investigates the use of both active and passive voice in research articles. In this chapter, we will first summarize the findings of our analysis of voice use in both social and scientific research articles and the results of the test on problematic verbs in voice use. Then, pedagogical implications are discussed. To contextualize the research results, we explicate the problems Chinese EAP/ESP writers may have with voice choice, making a number of suggestions. In addition, as we propose to link voice use to rhetorical structure and genre from a functional perspective, the relationship among voice, rhetorical structure, and the genre of research articles is clarified, also based on our research results. At last, we will also make some suggestions for future research.



SUMMARY OF RESULTS

The Analysis

The analysis explored the use of active and passive voice in research articles and the possible factors influencing voice choice. In our quantitative analysis, it was found that passive voice is used more often in *JMS*, representing hard science, than in *ESP*, representing soft science; most passive constructions are agentless in both *JMS* and *ESP*. This result conforms to the objective nature of research articles to emphasize replicability of research. In *JMS*, a majority of *by*-agents are inanimate agents while over half of the *by*-agents in *ESP* are animate. This difference can be attributed to the dissimilar nature of these two research fields. The experiment in *JMS* focuses on the manipulation of materials, while *ESP* often reports investigation involving human subjects and discusses other informants'/researchers' perspectives. The qualitative

analysis shows the diverse functions of *by*-agents and, thus, renders them a new role. In addition, we suggest that discourse organization can influence the determination of the grammatical subject in a sentence and, in turn, voice choice. On the one hand, theme system may govern the text when it aims to focus on one particular topic. On the other hand, the given-to-new principle of information system is often followed in describing the step-by-step experimental procedure.

Verbs Often Confusing Chinese Learners

The test on easily misused verbs aims to clarify the relationship between verbs and voice choice and tries to explain the reason why Chinese learners are confused about the uses of certain verbs. Based on the analysis of the students' answers to the test items, we suggest some possible reasons for the misuses of ergative verbs and transitive/intransitive verbs. It can be further inferred that (1) Chinese learners may mistakenly think inanimate subjects should always take passive voice in order to construct a correct sentence (*form*, *develop* and *accelerate*); (2) active voice may be incorrectly applied because of the absence of *by*-agents in sentences containing ergative verbs; (3) Chinese learners may not be able to use contextual information to determine the choice between active and passive, and (4) Chinese learners do not have clear ideas about the relationship between voice use and subject/verb compatibility in terms of actor and action.

Lesson Plan

A lesson plan is designed to demonstrate how voice use can be taught to graduate students. The lesson plan aims to break the stereotype that the use of passive voice is to show the objective nature in scientific research, as suggested in many manual styles. On the other hand, it intends to take a functional approach, in contrast to the

traditional approach, to grammar teaching. The lesson plan focuses voice use at the discourse level, rather than grammatical rules. The content of a passage—either discussing a particular theme or describing an experimental process—plays a significant role in voice choice because of its relation with theme and information systems.

PEDAGOGICAL IMPLICATIONS AND CONTRIBUTION

The findings of the study provide the following pedagogical implications. Firstly, students should be taught that in research articles, passive voice is not merely used for reducing human involvement so as to ensure the replicability of research. More importantly, voice choice is also closely related to the discourse organization of research articles, particularly through theme and information systems. Secondly, passive voice is not necessary a weak construction. It can be used to create focus and improve cohesion and coherence in text to achieve effective communication. Thirdly, in writing genre of research articles, students need to know when and how to use passive constructions with expressed agents or without agents, and with animate or inanimate agents. Fourthly, the concept about verb transitivity should be taught or reviewed before the teaching of voice. Since the idea about passive voice is mainly dependent on the transitive nature of verbs, consciousness-raising exercises should be more important than transformation practices during the teaching process. Fifthly, at the discourse level, Chinese learners need to learn how subject, verb and context interact with one another to determine appropriate voice use. Finally, students should be also taught that some inanimate subjects can go with active verbs and theme and information systems play a crucial role in the determination of subjects, and, in turn, voice choice. Besides, EAP/EST teachers can use the lesson plan provided in the study in their teaching program and choose the appropriate materials according to

graduate students' academic backgrounds in order to meet their needs in writing the Methods section of research articles. It is also hoped that the lesson plan can provide some basic ideas about how to teach voice in context and inspire teachers to create their own tasks or activities for graduate students to master voice use in the genre of research articles.

Many graduate students compose their theses or dissertations usually by following some conventional rules (like tense variation indicating researchers' attitude). However, in the study, we discuss voice use from a functional approach. Voice, in this aspect, is the "consequence of subject choice which itself derives from considerations of information structure and cohesion" (Shaw, 1992, p.302).

VOICE, RHETORICAL STRUCTURE, AND GENRE

In our study, the discussion of voice choice in research articles is based on a functional perspective of voice and discourse organization. We argue that voice is more than a grammatical category. The high-level rhetorical structure of a text affects the choice of voice to achieve textual cohesion and coherence for effective communication. On the other hand, the rhetorical structure of a genre, such as research articles, is closely related to the communicative purposes of the genre. In addition, the relation between themes and sub-themes of a genre, realized in a string of sentences and the orderings among information, is significant to voice choice. The selection of an appropriate subject in a sentence, in fact, depends largely on a writer's idea about how to construct the paragraph and how to arrange information, which, in turn, influences voice use in the genre. Therefore, the functional approach taken in the present study renders voice a whole new role and proposes a new view of grammar as a device for the realization of rhetorical structure and discourse functions of a genre.

LIMITATIONS OF THE STUDY

There are a number of limitations of the study. Firstly, we merely focus on the Methods section of the research articles. It may be of interest to analyze voice use and their functions in other sections, which may contribute to more insightful ideas about the use of passive voice in research articles. Secondly, the size of the corpus is small. There are only 48 articles in the journals of *JMS* and *ESP*. It is considered that the interpretation of the analysis results may be more reliable and objective if we collect more articles from both journals or include journals from other disciplines. Thirdly, as indicated in Chapter Three, participants of the experiment are students in freshmen English classes rather than our target learners, graduate students. Thus, the result of our test cannot show if the transitive/intransitive nature of verbs has influence on graduate students' misuse in voice use.



SUGGESTIONS FOR FUTURE RESEARCH

In the present study, we propose that voice choice in the Methods section of research articles is closely related to the theme and information systems of text. We also discuss why Chinese learners tend to choose incorrect voice when encountering certain verbs and demonstrate how to teach voice in context. Further investigation can be directed towards the following questions.

Firstly, besides theme and information systems, are there other factors influencing voice use in research articles? If there are, how do they affect the choice between active and passive voice and, in turn, the whole discourse? Secondly, the functions of *by*-agents as well as their presence/absence in research articles can be further explored. Then, although we suggest several reasons for some easily misused verbs in voice choice in terms of transitive/intransitive characteristics, future research may be conducted from other perspectives, such as semantic meanings of verbs. On

the other hand, whether there exists interference from the native language of learners can be an interesting research question. At last, the lesson plan is designed to show how to teach voice in context, but it has not been put into practice. We hope that the lesson plan can be applied in an EAP/EST class, and both students' and teachers' feedback can be collected. Besides, future studies can also expand the lesson plan or even provide more learning tasks for graduate students to acquire the use of passive voice in research articles.



APPENDIXES

APPENDIX A SOURCES

Journal of Materials Science: Materials in Electronics (JMS)

- Text 1a. Hamouda, H., Lassri, M., Abid, M., Lassri, H., Saifaoui, D., & Krishnan, R. (2004). Magnetic studies of spin wave excitations in Co/Pt multilayers. *Journal of Materials Science: Materials in Electronics*, *15*, 395-398.
- Text 2a. Zhang, H., Fang, L., Yang, J. F., Yuan, R. Z., & Liu, H. X. (2004). Characterization and dielectric properties of Ba₅NdZnM₉O₃₀ (M=Nb, Ta) ceramics. *Journal of Materials Science: Materials in Electronics*, *15*, 327-329.
- Text 3a. Tena, M. A., Llusar, M., Badenes, J. A., Calbo, J., & Monrós, G. (2004). Structural and electrical conductivity studies on (M,V)-TiO₂ (M=Al, Cr, Fe) rutile solid solutions at high temperature. *Journal of Materials Science: Materials in Electronics*, *15*, 265-270.
- Text 4a. Okur, S., Günes, M., Göktas, O., Finger, F., & Carius, R. (2004). Electronic transport properties of microcrystalline silicon thin films prepared by VHF-PECVD. *Journal of Materials Science: Materials in Electronics*, *15*, 187-191.
- Text 5a. Xiang, N., Leinonen, P., Ragala, L., Lyytikäinen, J., & Pessa, M. (2004). 1.02-um vertical-cavity surface-emitting lasers with strain-compensated InGaAs quantum wells. *Journal of Materials Science: Materials in Electronics*, *15*, 115-117.
- Text 6a. Wang, Shaohong, & Zhou, Heping. (2004). Sintering characteristics and crystallization for sol-gel-derived powders for low-dielectric and low-temperature sintering ceramics. *Journal of Materials Science: Materials in Electronics*, *15*, 55-59.
- Text 7a. Gushterova, P., & Sharlandjiev, P. (2003). Analytical solutions for determining the optical constants of very thin films. *Journal of Materials Science: Materials in Electronics*, *14*, 865-866.
- Text 8a. Mandal, N. P., & Agarwal, S. C. (2003). Surface effects in nanocrystalline silicon. *Journal of Materials Science: Materials in Electronics*, *14*, 797-798.
- Text 9a. Günes, M., & Akdas, D., Göktas, O., Carius, R., Klomfass, J., & Finger, F. (2003). Photoconductivity spectroscopy in hydrogenated

- microcrystalline silicon thin films. *Journal of Materials Science: Materials in Electronics*, 14, 729-730.
- Text 10a. Waters, J., Crouch, D. O'Brien, P., & Park, Jin-Ho. (2003). Fabrication of thin films of bismuth selenide using novel single-source precursors by metal organic chemical vapor deposition. *Journal of Materials Science: Materials in Electronics*, 14, 599-602.
- Text 11a. Zhu, B. L., Zeng, D. W., Wu, J., Song, W. L., & Xie, C. S. (2003). Synthesis and gas sensitivity of In-doped Zn nanoparticles. *Journal of Materials Science: Materials in Electronics*, 14, 521-526.
- Text 12a. Hayashi, K., Takahashi, Y., Matshbara, E., Nakahima, K., & Usami, N. (2003). 3D atomic imaging of SiGe system by X-ray fluorescence holography. *Journal of Materials Science: Materials in Electronics*, 14, 459-462.
- Text 13a. Chen, W. M., McNally, P. J., M. Dilliway, G. D., Bonar, J., Tuomi T., & Willoughby, A. F. W. (2003). Stress characterization of device layers and the underlying Si_{1-x}Ge_x virtual substrate with high-resolution micro-Raman spectroscopy. *Journal of Materials Science: Materials in Electronics*, 14, 455 – 458.
- Text 14a. Ohyama, H., Hayama, K., Takakura, K., Miura, T., Shigaki, K., Jono, T., Simoen, E., Poyai, A., & Claeys, C. (2003). Influence of irradiation temperature on electron-irradiated STI Si diodes. *Journal of Materials Science: Materials in Electronics*, 14, 451 – 454.
- Text 15a. Ye, L. L., Thölen, A., Jacob, A. P., Myrberg, T., Nur, O., & Willander, M. (2003). Structural roughness and interface strain properties in Si/SiO₂/Poly-Si_{1-x}Ge_x tri-layer system with ultrathin oxide. *Journal of Materials Science: Materials in Electronics*, 14, 247-254.
- Text 16a. Yoon, Dang-Hyok., Lee, B. I., Badheka, Prerak., & Wang, Xinyu. (2003). Barium ion leaching from barium titanate powder in water. *Journal of Materials Science: Materials in Electronics*, 14, 165-169.
- Text 17a. Bishay, A.G., Hunter, H., Fikry, A. G. W., & Ragai, H. F. (2003). Parallel components of an equivalent circuit of two-dimensional island gold films. *Journal of Materials Science: Materials in Electronics*, 14, 115-120.
- Text 18a. Lin, Yen-Sheng., Ma, Kung-Jeng, Yang, Chih-Chung, & Weirich, T. E. (2003). Effects of thermal annealing on quantum-dot-like structure of medium indium-content InGa_N/Ga_N multiquantum wells. *Journal of Materials Science: Materials in Electronics*, 14, 49-53.
- Text 19a. Peng, C., Zhang, Y., Cheng, Z. W., Cheng, X., & Meng, J. (2002).

Nitrate–citrate combustion synthesis and properties of $Ce_{1-x}Sm_xO_{2-x/2}$ solid solutions. *Journal of Materials Science: Materials in Electronics*, 13, 757-762.

- Text 20a. Brunner, F., Maaßdorf, A., Kurpas, P., Braun, A., Bergunde, T., Richter, E., Würfl, J., & Weyers, M. (2002). Critical issues of growth optimization for Ga_{0.5}In_{0.5}P/GaAs heterojunction bipolar transistors. *Journal of Materials Science: Materials in Electronics*, 13, 665-670.
- Text 21a. Farid, A. M., Abd El-Wahabb, E., & Fadel, M. (2002). Electrical and optical properties of (Sb₂Se₃)₂(Sb₂Te₃)₁ thin films. *Journal of Materials Science: Materials in Electronics*, 13, 609-614.
- Text 22a. Dibb, A., Tebcherani, S. M., Lacerda, W., Cilense, M., Varela, J. A., & Longo, E. (2002). Influence of the rare-earths oxides doped on the SnO₂CoOMnO₂Ta₂O₅ varistor system. *Journal of Materials Science: Materials in Electronics*, 13, 567-570.
- Text 23a. Shao, Y., Zheng, Jia-Gui., Zhang, Jing-Quan., Feng, Liang-Huan., Cai, Dao-Ling., Wei Cai¹, Wu, Li-Li., Cai, Ya-Ping., Li, Bing., Li, Wei., & Leng, Wen-Jian. (2003). Structure and optical properties of polycrystalline Cd_{1-x}Zn_xTe thin films prepared by simultaneous evaporation. *Journal of Materials Science: Materials in Electronics*, 14, 503-506.
- Text 24a. Madhuri, K. V., Rao, K. S., Naidu, B. S., Hussain, O. M., & Pinto, R. (2002). Characterization of laser-ablated V₂O₅ thin films. *Journal of Materials Science: Materials in Electronics*, 13, 425-432.

English for Specific Purposes (ESP)

- Text 1b. Fuertes-Olivers, P. A. & Gómez-Martínez, S. (2004). Empirical assessment of some learning factors affecting Spanish students of business English. *English for Specific Purposes*, 23, 163-180.
- Text 2b. Esteban, A. A., Pérez Cañado, M. L. (2004). Making the case method work in teaching Business English: A case study. *English for Specific Purposes*, 23, 137-161.
- Text 3b. Fortanet, I. (2004). The use of 'we' in university lecture: Reference and function. *English for Specific Purposes*, 23, 45-66.
- Text 4b. Pickering, L. (2004). The structure and function of intonational paragraphs in native and nonnative speaker instructional discourse. *English for Specific Purposes*, 23, 19-43.
- Text 5b. Ruiying, Y. & Allison, D. (2003). Research articles in applied linguistics: Moving from results to conclusions. *English for Specific*

- Purposes*, 22, 365-385.
- Text 6b. Bloch, J. (2003). Creating materials for teaching evaluation in academic writing: Using letters to the editor in L2 composition courses. *English for Specific Purposes*, 22, 347-364.
- Text 7b. Moreno, A. I. (2003). Matching theoretical descriptions of discourse and practical applications to teaching: The case of causal metatext. *English for Specific Purposes*, 22, 265-295.
- Text 8b. Badger, R. (2003). Legal and general: Towards a genre analysis of newspaper law reports. *English for Specific Purposes*, 22, 249-263.
- Text 9b. Charteris-Black, J. & Musolff, A. (2003). 'Battered hero' or 'innocent victim'? A comparative study of metaphors for euro trading in British and German financial reporting. *English for Specific Purposes*, 22, 153-176.
- Text 10b. White, M. (2003). Metaphor and economics: The case of growth. *English for Specific Purposes*, 22, 131-151.
- Text 11b. Newman, M., Trenchs-Parera, M., & Pujol, M. (2002). Core academic literacy principles versus culture-specific practices: A multi-case study of academic achievement. *English for Specific Purposes*, 22, 45-71.
- Text 12b. Martín, P. M. (2002). A genre analysis of English and Spanish research paper abstract in experimental social sciences. *English for Specific Purposes*, 22, 25-43.
- Text 13b. Moore, T. (2002). Knowledge and agency: A study of 'metaphenomenal discourse' in textbooks from three disciplines. *English for Specific Purposes*, 21, 347-366.
- Text 14b. Hewings, M. & Hewings, A. (2002). 'It is interesting to note that...': A comparative study of anticipatory 'it' in student and published writing. *English for Specific Purposes*, 21, 367-383.
- Text 15b. Basturkmen, H. (2002). Negotiating meaning in seminar-type discussion and EAP. *English for Specific Purposes*, 21, 233-242.
- Text 16b. Jackson, J. (2002). The China strategy: A tale of two case leaders. *English for Specific Purposes*, 21, 243-259.
- Text 17b. Paltridge, B. (2002). Thesis and dissertation writing: An examination of published advice and actual practice. *English for Specific Purposes*, 21, 125-143.
- Text 18b. Soler, V. (2002). Analysing adjectives in scientific discourse: An exploratory study with educational applications for Spanish speakers at advanced university level. *English for Specific Purposes*, 21, 145-165.
- Text 19b. Rowley-Jolivet, E. (2002). Visual discourse in scientific conference

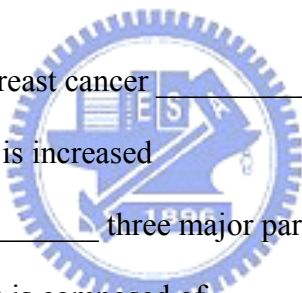
- papers A genre-based study. *English for Specific Purposes*, 21, 19-40.
- Text 20b. Crosling, G. & Ward, I. (2002). Oral communication: the workplace needs and uses of business graduate employees. *English for Specific Purposes*, 21, 41-57.
- Text 21b. Upton, T. A. & Connor, U. (2001). Using computerized corpus analysis to investigate the textlinguistic discourse moves of a genre. *English for Specific Purposes*, 20, 313-329.
- Text 22b. Ibrahim, Y. (2001). Doctor and patient questions as a measure of doctor-centredness in UAE hospitals. *English for Specific Purposes*, 20, 331-344.
- Text 23b. Martínez, I. A. (2001). Impersonality in the research article as revealed by analysis of the transitivity structure. *English for Specific Purposes*, 20, 227-247.
- Text 24b. Shi, L., Corcos, R., & Storey, A. (2001). Using student performance data to develop an English course for clinical training. *English for Specific Purposes*, 20, 267-291.



APPENDIX B TEST

同學您好：

我是交通大學英語教學所的研究生柳薇芬，現在正在從事科技論文與英語寫作的相關研究。非常感謝您撥冗填答此份測驗。此測驗的目的是為了了解大學生在使用英文寫作科技論文時對於主動及被動語態的運用。以下共有 20 句英文句子，我們已將主動與被動的使用分別寫在選項(A)及(B)中。請依照您對英語主動及被動的理解和文句的語意來判斷各句需用何種語態，並將答案選項填入題號前的直線中。此次測驗不會影響您此科目的學期成績。請您安心作答！再次感謝您的協助。

- 
- _____ 1. The incidence of breast cancer _____ with age.
(A) increases (B) is increased
- _____ 2. The device _____ three major parts.
(A) composes (B) is composed of
- _____ 3. Knowledge in the field of genetics _____ very rapidly.
(A) has been developing (B) has been developed
- _____ 4. The theory _____ that living in an English-speaking country is not necessarily the best method to acquire English.
(A) suggests (B) is suggested
- _____ 5. The result can _____ improvements in experimental conditions.
(A) attribute to (B) be attributed to
- _____ 6. This trend will _____ when companies move beyond the wired centers to offer learning in remote regions and around the world.
(A) accelerate (B) be accelerated

- _____ 7. No single factor _____ to dominate.
(A) appears (B) is appeared
- _____ 8. The model _____ about 13000 four-node quadrature elements.
(A) comprises (B) is comprised of
- _____ 9. Large amounts of money _____ in this investment.
(A) involve (B) are involved
- _____ 10. The MST method is likely to _____ in those cases.
(A) fail (B) be failed
- _____ 11. Many of the papers _____ their attention on these two influences.
(A) focus (B) are focused
- _____ 12. These problems _____ all of us.
(A) concern (B) are concerned
- _____ 13. They can see how its colors _____ and where paint has flaked.
(A) have faded (B) have been faded
- _____ 14. A number of products _____ which are permeable to air and water.
(A) have developed (B) have been developed
- _____ 15. The findings _____ substantially when the statistical analysis takes into account background factor.
(A) change (B) are changed
- _____ 16. In certain instances, the deposits _____ on machine surfaces at the exact location where the oil has degraded, for example, hot surface coking.
(A) form (B) are formed

_____ 17. With the device, the unwanted factor will _____ automatically.

(A) remove (B) be removed

_____ 18. Many people have accepted that theory and believed that cancer

_____ entirely through heredity.

(A) passes on (B) is passed on

_____ 19. Chemical transformations _____ in the process of the

experiment.

(A) occur (B) are occurred

_____ 20. Many of the crimes _____ drugs.

(A) involve (B) are involved



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