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| **RESEARCH ARTICLE**

A Pragmatic Analysis of Hedges in *Silent spring* under the Perspective of Adaptation Theory

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| **ABSTRACT**

Vagueness is a natural property of human language. Hedges, as a special form of vague language, are widely used in human language. On the basis of Adaptation Theory, this paper makes a pragmatic analysis of hedges in *Silent spring*. The study finds that the writer realizes three pragmatic functions by adapting to the physical, social and mental world. These three pragmatic functions are: increasing the accuracy of the information, reducing personal responsibility and expressing motions. This paper may be helpful to further studies on the genre of science books.

| **KEYWORDS**

Silent spring; Hedges; Adaptation Theory; Pragmatic Analysis

| **ARTICLE INFORMATION**

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1. Introduction

Human language possesses a kind of natural properties — vagueness and hedge is one of the most important parts of the vague language family. Its use has always been regarded as a pragmatic strategy. Thus this paper also provides a pragmatic analysis of hedges.

Zadeh (1965) first introduced the concept of vagueness and put forward the fuzzy set theory. His theory has a great influence on further research of vague language. Lakoff (1972) proposed the discovery of hedges. In his thesis ""Hedges: A Study in Meaning Criteria and the Logic of Fuzzy Concepts"" he defined hedges as those ""whose job is to make things fuzzier or less fuzzy"" (Lakoff, 1972, p.472).Lakoff's definition of hedges is a milestone in the field of vague language. Since then, scholars have begun to take various perspectives to make studies on hedges, such as semantics, pragmatics, sociolinguistics, discourse analysis and cross-cultural communication (Zeng, 2005).

A few scholars proposed their classifications of hedges (see Zadeh, 1972; Prince et al. 1982; Brown & Levinson, 1987; Salager-Meyer, 1997; Hyland, 1998). Among their classifications, Prince et al. (1982)'s classification is the most comprehensive and influential one, so the classification of hedges in *Silent spring* obeys their classification.

Silent spring, written by the American marine biologist Rachel Carson, ""played a vitally important role in stimulating the contemporary environmental movement"" (Lutts, 2000, p.17). It is an environmental science book first published in 1962 and listed in Discovermagazine's ""25 greatest science books of all time"" in 2006. The book documents the environmental harm caused by the indiscriminate use of pesticides, leading to a debate over environmentalism and DDT restrictions.

However, such an influential book has not attracted enough attention in literary studies. Previous studies mainly paid attention to theauthor's ecological thoughts, but a thorough analysis of this book is rare. Because science book is a genre between literature

and academic paper, and to some extent, *Silent spring* is a representative of the most influential science books around the world, it is worths a text analysis. To understand how *Silent spring* can exert such great influence on society, text analysis is needed. Text analysis includes many aspects, namely, the lexical aspect, syntactical aspect and textual aspect. This paper mainly focuses on the lexical aspect.

Adaptation Theory, first proposed by Verschueren in 1987, explains the use of language as a process of adaptation to variables of the physical, social and mental world. Viewing from his perspective, language use must consist of consciously or unconsciously continuous making of linguistic choices due to language internal or external reasons (Verschueren, 2000, p.55). Obviously, the use of hedges also consists of linguistic choices.

In conclusion, few scholars pay attention to studies on the text itself in *Silent spring*. This paper offers a pragmatic analysis of the use of hedges in *Silent spring*, aiming to reveal features and pragmatic functions of hedges in this science book, which may be helpful to further studies on the science book genre.

2. Previous studies on Adaptation Theory
The past five years have witnessed a wide application of Adaptation Theory. The research content of recent studies consists of three areas: translation, language teaching, and pragmatics. As for the theoretical basis, most of them only take Adaptation Theory as a theoretical perspective, and a few scholars make a combination of Adaptation Theory and another theory. The review of papers published in the past five years is based on the research content.

2.1 The application in translation studies
Most applications of Adaptation Theory reflect successful results in translation studies. Wang (2018) proposes that Adaptation Theory cannot be used to describe and summarize specific contexts, so it cannot be the guide of spespeakers'' adaptation operations. Hence he makes an innovation to literary metaphor translation. He combines the Context Parameter Theory with the Adaptation Theory to explore cognitive mechanisms and motivations in the metaphor translation of Lu Xun's works. On the basis of these theories, the author's modification of some metaphor translations proves that the combination of these theories makes the metaphor translation process describable, explainable, operative and provable. Zhang (2018) makes an exploration of guide speech translation. He claims that Verschueren's structural objects of adaptability should be aware of in guide speech translation. The structural objects of adaptability are reflected in lexical, syntactical, and textual aspects when translating guide speech. The analysis of some cases shows: To help tourists better understand the content of guide speech, translators should consider the adaption of word meaning, word class, word structure, sentence structure, modifiers in sentences, and textual structure when necessary. Li (2018) pays attention to the translation of ethnic literature on the basis of the Adaption Theory. He puts forward three existing problems in translating ethnic literature: the switch in the communicative context among the author, the translator and the reader is not successful; some translators do not pay attention to proper adaptability of the context of structural objects; the cultural context of the original literary work does not be reappeared well in the translation. To solve these problems, he gives some suggestions respectively. Xu & Xiao (2018) make a comparative study of Legge and Whaley's translation of *The Analects*. In their research, the Rewriting Theory and the Adaptation Theory form the theoretical basis. They analyze how translators make adaptive decisions in the manipulation of ideology and poetics. Their research shows that although ideology and poetics are objective factors to translators, translators can decide whether adapt to the target language's social ideology and poetics or not with the help of their subjectivity. This is why different versions of translation can coexist. Bai (2018) makes an exploration of the adaptation to the Chinese language and culture in C-E publivity material translation. By comparison with expressions of the same concept in Western countries, she claims that translators should adapt to Chinese communicative purpose and Chinese historical background; thus, the publicity materials translation can show the growing status of China around the world. Wang (2019) explores the selection mechanism of translation strategies on the basis of Skopos Theory and Adaptation Theory. The choice of translation strategy, from her point of view, is related to translator'sor's subjectivity, thesponsor's purpose, the requests for cohesion and coherence in the source or target language, readers'' purpose, and the originalauthor's intention. The sponsor, the translator, the readers, and the original author are interrelated, and they work together to influence the choice of translation strategy.

In conclusion, when scholars use Adaptation Theory in translation studies, some of them try to combine it with another theory, while others do not. Nearly all of them give examples to verify the effect of the application and get good results. Wang (2019) is a completely theoretical discussion.

2.2 The Adaptationn in language teaching
From 2018 to 2022, three papers discussed the application of Adaptation Theory in language teaching. Wu (2018) conducted deep research on English classroom teaching. She puts forward suggestions on language teaching strategies from three aspects: the mental world, social world and physical world. Considering the mental world, she emphasizes the importance of students themselves, such as their characteristics, learning habits, learning interests, etc. Besides, adaptation to the social world requires

more simulations of real communicative situations in class. Moreover, from her point of view, teachers should realize that adaptation to the physical world needs them to construct temporal and spatial situations in class so that students can take good command of temporal and spatial expressions. Wang (2019) realizes the deficiency of communicative competence among ethnic students, and she proposes that to improve their communicative competence, teachers should introduce more knowledge from other cultures into classes and tell students figures of speech, tones, polysemy, expressions in accordance with registers, communicative skills in another language. Li & Wu (2020) focus on spoken English teaching in universities. They put forward the value of AdaptationTheory's application to oral communication. Then suggestions on learning environment, communicative contexts, pedagogy, cultural knowledge learning and out-of-class activities are given from the perspective of Adaptation Theory.

In the language teaching area, applications of Adaptation Theory are limited at the assumption level. Further studies may focus on the effect of turning these suggestions into practice.

2.3 The adaptation in pragmatics
According to the data language, 6 papers in pragmatics published in the past five years can be divided into two types: Chinese text analysis and English text analysis. 4 papers belong to Chinese text analysis, and 2 belong to English text analysis.

Shen's (201 's analysis is based on data from the Chinese social media application Weibo. She explores features and the adapted contexts of socialized media language. The features of socialized media language can be summarized as creations of new words, structure imitations and formations of new language styles. In her opinion, these phenomenons show the adaptation to online users' mental needs, immediate communication needs and the virtual space created by the Internet. Wang (2020) analyzes the metalanguage of a mediation TV programme's host. After data collection and observation, the researcher finds that in a mediation TV programme, the host's different uses of metalanguages reflect his metalanguage awareness as the TV programme host. Moreover, his use of metalanguage is, in fact, the adaptation to the physical world. Various metalanguages help construct an interpretation framework for people who are waiting for a mediation; thus, the mediation process can be promoted successfully. Shi (2022) discusses the adaptive features of the discourse marker "你看". Through analyzing a few examples using "你看", this study concludes that the adaptive manner of "你看" depends on its contexts, sometimes it is an automatic adaptation, but sometimes it is an adjusted adaptation. The subjective context (mental context) lies in the center position of the contextual complex. Liu (2020) and Du (2021) collect data from cross-examination in the courtroom and political news, respectively. Both of them are English data analyses. Liu (2020) finds that the defendant's use of hedges increases the credibility of his utterance, avoid absolute utterance, provides appropriate information and shows politeness. Du (2021) finds that hedges in political news give the right amount of information, prevent speaking absolutely, increase the credibility of news reports and protect the editor him/herself.

The application of Adaptation Theory in pragmatics concerns the use of network buzzwords, metalanguage, discourse markers, and hedges in courtroom discourse and political news. In other words, the data are collected in various ways.

To sum up, recent studies on Adaptation Theory tend to apply Adaptation Theory to translation studies and pragmatic studies. The application of this theory in language teaching just takes up a small proportion. The data used for analysis is collected from various areas, including translations, laws, social media, and others. Some scholars even make innovations in extending Adaptation Theory. The pragmatic analyses of vague language also appear in recent papers, but all these papers in the past five years do not involve a discussion of vague language in a science book, and that's the reason this paper tries to use Adaptation Theory to enrich the research on *Silent spring* from lexical level.

3. Theoretical framework
The concept of Adaptation Theory was first put forward in Verschueren's article Pragmatic as a Theory of Linguistic Adaptation. Later in 1999, he supplemented this pragmatic theory in his book Understanding Pragmatics. In this book, he proposes a general question, "What do people do when using language?" (Verschueren, 2000, p.55) and then gives a trivial answer to this question: making choices. From this answer, Verschueren tries to deduce some key notions that help people better understand linguistic phenomenons. By introducing these notions, the framework of Adaptation Theory becomes clear.

Verschueren believes that language user can make proper linguistic choices because language possesses three features: variability, negotiability, and adaptability. Variability, in his word, means "the property of language which defines the range of possibilities from which choice can be made" (Verschueren, 2000, p.59). Negotiability means that all linguistic choices are not made under the guidance of mechanical rules but based on highly flexible rules and strategies (Verschueren, 2000, p.59). Adaptability enables language users to make negotiable linguistic choices from a variable range of possibilities so that their communicative needs can be satisfied (Verschueren, 2000, p.61). Among the three features, adaptability is the most significant one because it enables us to

make a pragmatic description and explanation of linguistic choices (He & Yu, 1999, pp.431-432). Verschueren then proposes four angles of investigation to make pragmatic descriptions and explanations possible. These four angles include contextual correlates of adaptability, structural objects of adaptability, dynamics of adaptability, and salience of the adaptation processes

Contextual correlates of adaptability include all the ingredients of the communicative context with which linguistic choices have to be interadaptable (Verschueren, 2000, p.66). The physical world, social world and interlocutors' mental world are considered in the communicative context. The physical world consists of temporal deixis, spatial deixis and other material conditions concerned with the speaker and the interpreter, but temporal deixis and spatial deixis are more important than others. The social world refers to principles and norms regulated by social occasions and environments. The mental world involves cognitive and emotional elements such as personality, emotion, desire, and motivation of the speaker and the interpreter (Verschueren, 2000, p.88). In other words, the choice of language in use must be adaptable to the communication context. This is what contextual correlates of adaptability, and it is depicted in Figure 1.
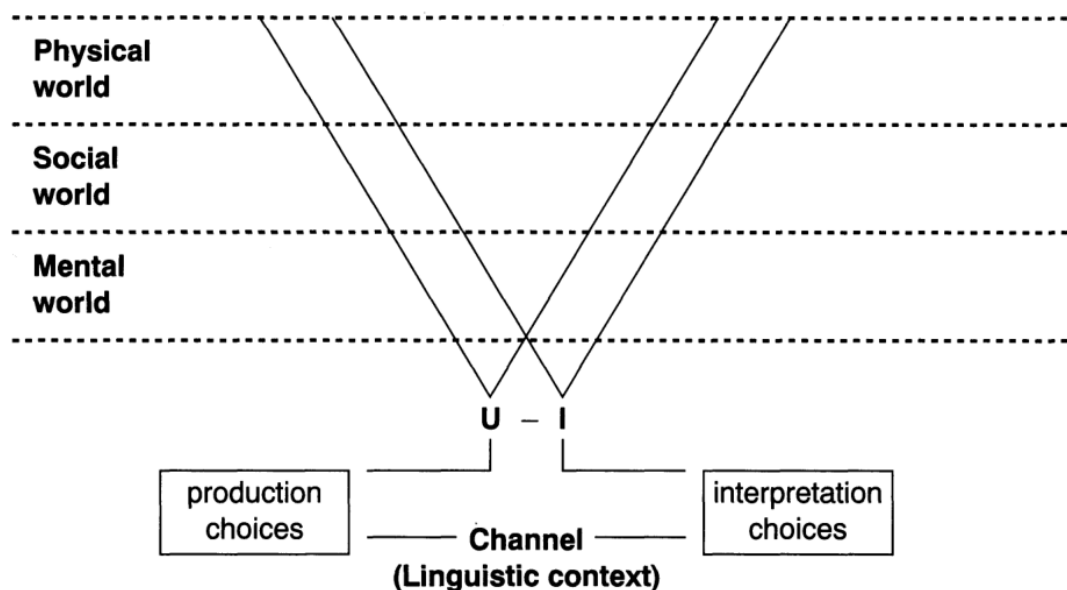

Figure 1 Contextual Correlates of Adaptability

Structural objects of adaptability indicate that language choices can occur in all possible linguistic structures. Dynamics of adaptability means that the adaptation process develops over time. The salience of the adaptation processes means that language choices made by people depend on different degrees of consciousness. In different contexts and cultures, the salience degree is inconsistent.

The use of hedges is closely related to context, so contextual correlates of adaptability are introduced in detail in this section, and this study will mainly explore contextual correlates in Chapter 5.

4. Methodology
4.1 Research questions
This paper attempts to explore and investigate the use of hedges in *Silent spring*. Because of this significance, this paper aims to answer the following three questions:

(1) What kinds of hedges have been used in *Silent spring*?
(2) What is the frequency of hedges in *Silent spring*?
(3)What are the pragmatic functions of hedges in *Silent spring*?

4.2 Data Collection and Processing
The data used in this paper are collected from 17 chapters of *Silent spring*. Based on these data, the author establishes a single English text corpus, amounting to 87 258 words in total. Both quantitative and qualitative methods are adopted to analyze these data. Two tools are employed in this paper: BFSU Qualitative Coder 1.1 and Antconc 4.1.4. BFSU Qualitative Coder 1.1 is a manual labeling tool developed by a corpus research group at Beijing Foreign Studies University. It is used to append explanatory linguistic

information to corpus text. In other words, the text can be annotated in a user-defined way according to the researcher's needs. Antconc 4.1.4 is a free software and corpus analysis toolkit invented by Laurence Anthony. It is used in this study to show the frequency of hedges and the context of these hedges. With the help of these tools, the data are processed through the following steps:

Firstly, 17 chapters in *Silent spring* are transferred into a Word file. The author cleans these texts and saves them as a TXT file. Next, on the basis of Prince's classification of hedges, the author uses BFSU Qualitative Coder 1.1 to annotate four types of hedges in *Silent spring*. The annotated code is designed and shown in the following table 1.

The identification of hedges depends not only on their literal meaning but also on their contexts, for example, in the sentence, "Since the mid-1940's over 200 basic chemicals have been … brand names", "over" is a hedge, but in the sentence "On the mornings … only silence lay over the fields and woods and marsh", "over" is not a hedge, so time-consuming manual work is needed.

Types of hedges	Code	Example
Adaptors	<Adaptor>	<Adaptor>merely<Adaptor>
Rounders	<Rounder>	<Rounder>a few<Rounder>
Plausibility Shields	<Plausibility>	<Plausibility>may<Plausibility>
Attribution Shields	<Attribution>	<Attribution>according to<Attribution>

Table 1 Annotation code and examples of hedges

After manual annotation, the overall frequency of four types of hedges is calculated, and the distribution of these hedges is clearly reflected in AntConc 4.1.4.

Finally, according to the frequency of these types of hedges, this paper provides an analysis to discuss the distribution and pragmatic functions of different types of hedges by citing some examples.

5. A pragmatic analysis of hedges in *Silent spring*
5.1 Frequency and distribution of hedges in Silent spring
Prince et al. (1982) divide hedges into two types: approximators and shields. Approximators can affect the truth condition of a sentence, while sheilds do not. Approximators are further divided into adaptors and rounders. Adaptors limit the extent to which the original sentence's meaning is expressed. In other words, adaptors can make expressions closer to reality (He, 1985, p.28). Examples of adaptors can be: *somewhat, quite, almost, kind of, sort of, and really*. Rounders restrict to hedges that can determine the range of a topic so that the hearer can easily understand the meaning in this range. Some examples of rounders are *approximately, about, around, more than, and at least*.

Shields are used to revealing the attitude of the speaker. They can be divided into two subtypes: plausibility shields and attribution shields. Plausibility shields represent the addresser's direct reasoning or hesitant attitude, such as *I think, I suspect, seem, I believe, may, could, might, must*. Attribution shields refer to the third party's opinion, which indirectly expresses the speaker's attitude. Typical examples of attribution shields are: *according to sb. says/said, reported (that), it is said that*.

Based on Prince et al. (1982) 's definition and classification of hedges, the hedges in *Silent spring* are collected and classified in the following list:

Approximators:
Adaptors: only, very, some, even, almost, often, especially, merely, actually, usually, seldom, always, extremely, completely, relatively, just, quite, virtually, somewhat, entirely, really.

Rounders: many, about, several, a few, more than, at least, nearly, over, millions of, less than, thousands of, a great many, billions of, hundreds of, or so.

Shields:
Plausibility shields: may, perhaps, might, seems/seem/seemed, would, probably, could, must, suppose, presumably, can, likely, possibly, possible, unlikely.
Attribution shields: according to, reported/has reported/reports/report, sb. says/said/say/has said, sb. declared/has declared/declare/declares, sb. believes, sb. states/stated/has stated, warns/has warned, in the words of, sb. found.

The frequency of detailed forms of hedges in *Silent spring* is counted and shown in the following table:

type	subtype	hedges (only top five of each type are listed)	total frequency (all hedges of each type is calculated)
Approximator	Adaptor	some (307), only (156), very (154), even(134), almost (62)	940
	Rounder	many (175), about (71), a few (42), more than (39), at least (31)	463
Shield	Plausibility shield	may (220), perhaps (42), might (34), seems (32), would (29)	530
	Attribution shield	says/said/say/has said (37), reported/has reported/report/reports (23), according to (22), sb. declared/has declared/declare/declares (11), sb. believes (6)	162

Table 2 The frequency of hedges in *Silent spring*

From the above table, it is clear that in *Silent spring*, Rachel Carson uses approximators more than shields. Adaptors and plausibility shields are the two most frequently used subtypes of hedges. In the following sections, this paper will make an analysis of the pragmatic functions of these hedges and show readers how to realize these functions on the basis of Adaptation Theory.

5.2 Pragmatic Functions of Hedges in Silent spring
In this section, qualitative analysis of hedges in *Silent spring* will be given to show their pragmatic functions. The pragmatic functions of hedges in *Silent spring* can be summarized as: increasing the accuracy of the information, reducing personal responsibility, and expressing emotions.

5.2.1 Increasing the accuracy of information
Sometimes the proper use of hedges can increase the accuracy of a sentence. Both Lakoff (1972) and Cai (2002) have similar expressions, supporting the function of hedges in increasing the accuracy of information. In *Silent spring*, the use of adaptors and attribution shields shows their function to increase the accuracy of the writer's expressions. The analysis of the following examples is a reflection of increasing the accuracy of information.

Example 1
Meanwhile, investigators in Austin noticed an odor associated with the insecticides chlordane and toxaphene. It was <u>especially</u> strong in the discharge from one of the storm sewers.

In the first example, "it" refers to an odor. The use of adaptor "especially", to some extent, emphasizes that the high unpleasant degree of the smell comes from a storm sewer's discharge. The writer attracts readers' attention to the polluted rainwater when using this adaptor to clarify investigators' findings, and by doing so, the strong unpleasant smell from rainwater becomes abnormal. If the adaptor "especially" does not appear in this place, readers may not realize the fact that the rainwater has been polluted. Thus the use of the adaptor "especially" here increases the accuracy of information.

Example 2
Yet some 7,000,000 pounds of parathion are now applied to fields and orchards of the United States — by hand sprayers, motorized blowers and dusters, and by airplane. The amount used on California farms alone could, <u>according to</u> one medical authority, "provide a lethal dose for 5 to 10 times the whole world's population."

Parathion is a kind of insecticide which was used widely in the United States at that time. Here the writer uses the attribution shield "according to" to prove that the horrible effect brought by the large amount of parathion being used on California farms is not just the writer's self-prediction. The lethal effect is put forward after the spraying amount is calculated by a medical authority.

Because of using "according to", the strong lethal effect caused by just the amount of parathion used on California can be trusted by readers. The use of "according to" helps offer the prediction source, so it increases the accuracy of information.

5.2.2 Reducing personal responsibility
In written works, writers will do something to protect himself/herself from being affected by unpleasant or unwanted things. Especially in science books, whose target readers are\ the public, writers' expressions must consider credibility. They do not want to use completely subjective language to reduce the credibility of their books. Meanwhile, they do not want to be queried by their readers. Thus the use of hedges can help them transfer or avoid their responsibility. Some examples will be given to prove this function of hedges.

Example 3
In spite of the enormous havoc that had been wrought in the name of eradicating the Japanese beetle, the treatment of more than 100,000 acres in Iroquois County over an eight-year period <u>seems</u> to have resulted in only temporary suppression of the insect, which continues its westward movement.

In example 3, the writer uses "seems", showing her uncertainty about the result of this eradication war. Because of her limited knowledge, she does not know whether beetles will make a comeback after this continuing eradication program is finished or not. Thus she uses the plausibility shield "seems" to express her guess of the effect of the beetle eradication program. With the use of "seems", Carson avoids taking responsibility towards the wrongly expression of the program result.

Example 4
A liver damaged by pesticides is not only incapable of protecting us from poisons, but the whole wide range of its activities may also be interfered with.

The use of the plausibility shield "may" in example 4 shows Carson's uncertainty about the pesticides' damage to a liver. Since pesticides are made of chemical materials and sprayed by human beings widely, human beings have to accept any possible result made by their widely use. One of the possible results is damaging a human being's liver, but to what extent will the damage be? At that time, the writer did not find medical proof. Hence she can just make a guess based on her own medical knowledge, probably knowledge of the liver's function. The use of plausibility shield "may" changes an absolute expression into a flexible one. Meanwhile, the responsibility for ensuring the authenticity of her expressions is avoided. Thus the use of "may" reduces Carson's personal responsibility.

5.2.3 Expressing emotions
Carol B. Gartner once summarized Rachel Carson's intention to finish *Silent spring*. She said: "Her basic strategy was pragmatic, based upon a meliorist philosophy: give people knowledge in a form they can understand, and they will act on it; show people how we are destroying our earth, and they will move to curb the destruction. Her goal was to initiate change." (Gartner, 2000, p.103) Doubtlessly, this intention influenced Carson's expressions. To achieve her goal, her words must have the power to resonate with readers. The use of hedges is a way to express her emotions. It is also a way to facilitate mental communication between the writer and readers.

Example 5
In the same way, and perhaps quite unknown to us, other plants that we ruthlessly eradicate may be performing a function that is necessary to the health of the soil. One <u>very</u> useful function of natural plant communities — now <u>pretty</u> generally stigmatized as "weeds" — is to serve as an indicator of the condition of the soil. This useful function is, of course, lost where chemical weed killers have been used.

This example shows the actual benefit of weeds and the public's ignorance of its benefit. The use of the adaptor "very" shows Carson's full approval of the function of weeds. If weeds can grow in this soil, it means that this soil is fertile for needed plants and weeds to grow. Thus its useful function is to be a marker in soil. The writer uses "very" to express her objection to weed eradication. Moreover, the "very useful" function of weeds is opposite to a general impression of them. The use of the adaptor "pretty" increases the degree of public stigmatization of weeds. It strengthens public aversion to weeds. These two adaptors show two different emotions to readers: love and hate.

Example 6

Like dieldrin, aldrin is <u>extremely</u> toxic.

Both dieldrin and aldrin are insecticides. Carson here uses the adaptor "extremely" to emphasize the high toxicity of these insecticides to human beings. With the use of "extremely", the writer aims to remind readers to think about the harm of insecticides to themselves when widely spraying insecticides. It is a sign of warning, which expresses the writer's seriousness and worry.

To sum up, the above six examples clearly show that hedges in *Silent spring* have three main pragmatic functions: increasing the accuracy of the information, reducing personal responsibility and expressing motions. In the following sections, the analysis will focus on the realization of these pragmatic functions from the perspective of Adaptation Theory.

5.3 Realization of pragmatic functions from the Perspective of Adaptation Theory

According to Adaptation Theory, language use is a continuous process of making linguistic choices. The writing process of *Silent spring* is also a process for the writer to make numerous linguistic choices. Rachel Carson's writing goal, as mentioned above, is also her communication purpose. In order to fulfill this purpose, realizing the function of hedges in communication is necessary. Thus the writer needs to constantly make choices adapting to the context of communication. In the following sections, some examples will show the realization of the pragmatic functions of hedges in *Silent spring* under contextual adaptation.

5.3.1 Adaptation to physical world

In physical world, temporal reference and space reference are the two most important components. Temporal reference includes the time of events, speech and reference. Spatial reference represents the place where the event happens. These two kinds of reference should be considered by the writer when making choices of hedges in the writing process.

Example 7

The task of confining the gypsy moth to the northeastern corner of the country has been accomplished by a variety of methods, and in the <u>nearly</u> one hundred years since its arrival on this continent, the fear that it would invade the great hardwood forests of the southern Appalachians has not been justified.

In this example, "nearly" is a rounder which is used to modify time deixis. Because the materials of gypsy moth in hand are limited, the writer can't make sure when the gypsy moth first arrived in the United States. Thus she uses the rounder "nearly" to expand the possible range of time. It is an adaptation to time elements in the physical world.

Example 8

Apparently, the groundwater between the arsenal and the farms had become contaminated, and it had taken 7 to 8 years for the wastes to travel underground, a distance of <u>about</u> 3 miles from the holding ponds to the nearest farm.

In this case, the writer employs "7 to 8" to indicate a long period of time for the waste to flow underwater. This rounder shows the writer's indeterminacy of the time needed. Instead of giving an absolute expression of time, the writer uses this hedge to extend the time range and meanwhile shows the length of time. The exact time in need for waste to travel is not important to readers; what the writer wants to tell is that the length of time in need is relatively long within a short distance (about 3 miles). The rounder "about" modifies space deixis. The use of "about" conveys the uncertainty of the real distance between the holding ponds and the nears farm, but the exact distance is also unimportant. Thus the writer uses "about" as a modifier to "3 miles" to extend spatial range. The use of these two rounders reflects the adaptation to time and spatial elements in the physical world.

According to the classification mentioned above, "nearly", "7 to 8", and "about" are rounders to expand the scope of range. In *Silent spring*, the writer tends to list enough evidence to stop readers from destroying the environment, so the accuracy of her evidence is important. When the exact time or number is unclear due to the writer's limited preparation on related aspects, the use of hedges adapting to the physical world may ensure the accuracy of information.

5.3.2 Adaptation to social world

As mentioned above, social world contains principles and norms which regulate the linguistic behaviors of participants in communication. When the communication is between the writer and readers, the writer's linguistic expressions are regulated by principles and norms in the social world. In other words, this means the writer's adaptation to the social world. The following examples of hedges will show the adaptation to the social world.

Example 9
Perhaps no community has suffered more for the sake of a beetleless world than Sheldon in eastern Illinois and adjacent areas in Iroquois County.

Example 10
Presumably, the human embryo deprived of oxygen may also develop congenital deformities.

In examples 9 and 10, "perhaps", "presumably", and "may" are three plausibility shields. The use of these plausibility shields shows the writer's prediction of some uncertain things. In example 9, a beetleless world's negative influence on human beings has appeared in many places because of the widely used insecticides. The writer's use of "perhaps" is a sign to show her indeterminacy of the degree of effect in each place. Maybe she has collected some data on most places being influenced, so she makes a presumption that Sheldon is the most influenced place. In example 10, "presumably" and "may" also show that congenital deformities are just her self-prediction of oxygen deficiency in the human embryo period. The use of these hedges offers a premise that the writer's expressions are not scientific and authoritative, helping the writer avoid the responsibility for the authenticity of her words.

Example 11
According to Dr. Hueper, horses, cows, goats, and pigs which of course, fed on this vegetation, showed loss of hair and thickening of the skin.

"According to" is an attribution shield. Carson uses it to prove that the following description of animal symptoms due to the arsenic-contaminated environment is authentic instead of an imagination made by herself. Using the attribution shield "according to" transfer the responsibility for word authenticity from the writer to Dr. Hueper.

Since Rachel Carson is a marine biologist, it is impossible for her to have knowledge from many other areas in her mind. The writing of *Silent spring* must be based on some scientific materials, and she is not a specialist in every area involved in this book. Thus the use of shields in these examples helps avoid or transfer her responsibility for the authenticity of her words. It is a kind of adaptation to her occupation, even to the social world.

5.3.3 Adaptation to mental world
The writing process and the reading process form a communication between the writer and readers. In this communication, the writer and readers express and exchange ideas, sometimes directly and sometimes indirectly. As has been discussed before, the mental world consists of personality, emotion, desire, motivation and many other cognitive and emotional elements of the speaker and the interpreter (Verschueren, 2000, p.88). Thus to make the communication successful, the writer should concern with readers' psychological needs. Science book readers want to gain some knowledge beyond their own cognition through reading. They care about the knowledge that is close to their daily life, and some of them may want to make a judgement on whether the writer's illustration is worth trusting or not. These needs require the writer to consider how to reflect this content in an understandable and convincing way. Thus the writer, needs to find authoritative evidence and make readers empathize with her. The use of hedges is necessary.

Example 12
John C. Pallister of the American Museum of Natural History reported in the summer of 1959 that his department had been getting a number of calls from neighboring apartments on Central Park West. "Every now and then," Mr. Pallister said, "a whole apartment house gets infested with young ticks, and they're hard to get rid of...They seem immune to DDT or chlordane or most of our modern sprays. It used to be very unusual to have ticks in New York City, but now they're all over here and on Long Island, in Westchester and on up into Connecticut."

The writer here uses "reported" and "said" as two attribution shields to make readers trust what they are reading is a real situation in their life. The clarification of the unusual phenomenon in apartment houses is made by a museum worker. His identity convinces readers that the deluge of ticks is closely related to the wide use of DDT and other sprays. Readers may feel in danger or feel worried when they realize that these ticks are invading their living places and hard to be eradicated. The use of these hedges is an adaptation to the reader's psychological need; thus, it is also an adaptation to the mental world.

Example 13
The herbicides, then, like the insecticides, include some very dangerous chemicals, and their careless use in the belief that they are "safe" can have disastrous results.

Before this sentence appears, Carson has briefly discussed some chemicals in insecticides. Here she uses two hedges, "very" and "can"; the former one is an adaptor, and the latter one is a plausibility shield. The writer aims to attract readers' attention to the danger of herbicides by using the adaptor "very". It implies her intention to stop the careless use of herbicides in daily life. The use of "can" shows that "have disastrous results" is her assumption about the actuality of widely using herbicides. Her assumption of the possible result is negative. The use of "very" and "can" in combination with "dangerous" and "have disastrous results" shows the writer's disapproval of the careless use of herbicides. To some extent, these two hedges show the adaptation to the writer's psychological needs, so these two hedges also show the adaptation to the mental world.

6. Conclusion

In conclusion, the hedges in *Silent spring* consist of four types: adaptors, rounders, plausibility shields and attribution shields. Adaptor takes the highest percentage of all hedges in this book, while attribution shields are fewer than other hedges. Through the analysis of some examples selected from this book, we find that hedges in *Silent spring* have three pragmatic functions: increasing the accuracy of the information, reducing personal responsibility and expressing motions. Based on Adaptation Theory, the adaptation to the physical world helps realize the pragmatic function of increasing the accuracy of information; the adaptation to the social world helps realizes the pragmatic function of reducing personal responsibility; the adaptation to the mental world helps realizes the pragmatic function of expressing motions.

Despite the intensive efforts, there are still some limitations in the present study: (1) Due to limited time, this paper only offers a simple analysis of a few examples; the result may be inaccurate. (2) This paper is just an exploration of the pragmatic functions of hedges in science books. Further research can pay attention to other aspects of this genre or the use of hedges in other registers.

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