
| RESEARCH ARTICLE

A Corpus-based Study on Shell Nouns in “N + that” Construction in Popular Science Discourse: Rachel Carson’s Works as Example

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| ABSTRACT

By adopting the corpus-based approach, the present study compares the frequency of use, semantic distribution, and stance expression of shell nouns in the “N + that” clause in popular science discourse compared with academic writing. The results show that, firstly, the frequency of use of shell nouns in the “N + that” clause in popular science is lower than that in academic discourse. Secondly, the semantic coverage of shell nouns in popular science discourse is smaller than that in academic discourse, but its semantic proportion distribution is roughly the same, mainly including mental and linguistic shell nouns. Thirdly, in popular science discourse and academic discourse, the proportion of shell nouns with epistemic stances occupies an absolute advantage, while the proportion of shell nouns with attitudinal stances is less. The proportion of shell nouns expressing attitudinal stance in popular science discourse is greater than that in academic discourse.

| KEYWORDS

Shell nouns; corpus; popular science discourse; Rachel Carson

| ARTICLE INFORMATION

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1. Introduction

Shell nouns, as a class of abstract nouns, have the “potential for being used as conceptual shells for complex, proposition-like pieces of information” (Schmid, 2000:4). Among the most typical and frequent examples are the nouns, *chance*, *fact*, *idea*, *news*, *problem*, and *reason*. This special type of noun has attracted academic attention and has been referred to as “vocabulary 3” (Winter, 1977), “label nouns” (Francis, 1986) and “general nouns” (Halliday and Hasan, 1976). These terms reveal different concepts and analysis paths for different research purposes, and the term shell nouns belong to the corpus-based approach of analysis (Wei, 2016).

To date, a great deal of previous research into shell nouns has focused on three aspects, its ontology study, including its definition, classification, and function; usage study in various discourses, including academic discourse such as thesis and journal articles; and second language acquisition study, such as the comparative study of writing between native speakers and second language learners. However, there is a relatively small body of literature that is concerned with shell nouns in popular science discourse.

The present study, focusing on the structure of the “N + that” clause, aims to investigate the use of shell nouns in Rachel Carson’s popular science corpus (RC-PSC) and compare that with Academic Writing, a sub-corpus of Brown Corpus, to explore the characteristics and functions of shell nouns in popular science discourse.

2. Literature Review

Schmid (2004:21-23) first carries out a systematic study of shell nouns based on the COBUILD corpus and finds four major types of lexico-grammatical patterns as follows: N-cl, N-be-cl, th-N and th-be-N. According to semantic features, shell nouns can be divided into six categories, including factual uses, linguistic uses, mental uses, modal uses, eventive uses, and circumstantial uses (ibid.: 88). Shell nouns have multiple functions, such as carrying the propositional message, organizing discourse, constructing stance and expressing evaluation and so on (Jiang, 2016). Since Schmid's study, more and more scholars have begun to pay attention to shell nouns and carry out their research. The relevant literature at home and abroad are reviewed as follows:

Previous studies abroad mainly focus on the following three aspects: firstly, the features of shell nouns usage in different discourse genres or disciplines are most studied, such as academic thesis on sociology, business, and engineering (Benitez-Castro, 2021), English textbooks (Johan, 2020), parliamentary debates (Alder et al., 2018), research papers on education (Mousavi et al., 2014), legal reports (Kanté, 2010); secondly, the functions of shell nouns are explored. Partington (1998) focuses on the linking function of shell nouns in academic discourse, and he believes that the use of this function will lead to fuzziness. Hyland et al. (2005) and Charles (2007) also conducted research on the evaluation constructing function of shell nouns in academic discourse; thirdly, a comparative study is made between native speakers and second language learners in terms of shell nouns. Francis et al. (1998) find that the frequency of the usage, semantic categories and modifier of shell nouns in Singaporean students' academic writing are lower than those in native students' academic writing. Schanding and Pae (2018) take shell nouns in English argumentative essays of Japanese and Turkish learners as research objects and find they use the patterns of shell nouns less frequently than native English speakers.

Previous studies at home are relatively late and started in 2004, marked by Zhang and Yang's introduction to Schmid's book *English Abstract Nouns as Conceptual Shells: From Corpus to Cognition*. Since then, a considerable amount of literature has been published on shell nouns, mainly focusing on the following three dimensions. Firstly, the features of shell nouns usage by Chinese learners are most investigated, especially in academic writing, including academic discourse on science and engineering (Qiu et al., 2021), international linguistic journal papers (Chen et al., 2020), graduate thesis (Lou, 2013; Liu et al., 2016), natural and social science discourse (Huang et al., 2021). Secondly, the construction of shell nouns is explored, such as N-be-that (Li et al., 2014), N-that appositive structure (Chen, 2015), the-of structure (Tian, 2019) and so on. Thirdly, the functions of shell nouns are discussed, including the discourse cohesion function (Jiang et al., 2014) and interpersonal function (Feng, 2016; Hu et al., 2021). However, there are few studies on shell nouns in other types of discourse, only involving English learner's dictionary (Zhang, 2007), political discourse (Hu et al., 2018), news discourse (Shan, 2018), and popular science discourse research has not yet been discovered.

To sum up, it has been found that there is still a gap between domestic and foreign related research. The studies on shell nouns abroad start earlier and present numerous papers with a wide range of topics, while the study of shell nouns at home start relatively late with a small number of papers and limited research topics. More importantly, the study of shell nouns in popular science discourse and comparative study is still unexplored. Therefore, this paper intends to study and analyze the frequency of usage, semantic distribution and function of shell nouns in popular science discourses based on RC-PSC.

3. Methodology

This present study is a corpus-based investigation to explore features and functions of the shell nouns of the "N + that" clause construction in RC-PSC. The reasons for choosing this construction are as follows: 1) the concordance lines of cataphoric shell nouns can be extracted more intuitively compared with those of anaphoric shell nouns for further analysis; 2) the "N + that" clause construction is most frequent in the lexico-grammatical constructions of cataphoric shell nouns. This study aims to answer the following three research questions:

1. What are the frequency features of shell nouns in the "N + that" clause construction in RC-PSC?
2. How is the semantic distribution of shell nouns in the "N + that" clause construction in RC-PSC?
3. What are the stance construction of shell nouns in the "N + that" clause construction of RC-PSC?

There are three steps to explore the three research questions: the first step is to build RC-PSC, including four novels by Rachel Carson, *Silent Spring* (1962), *The Sea Around Us* (1951), *The Edge of the Sea* (1955), *Under the Sea Wind* (1941). The irrelevant information, such as the cover, preface, appendix and so on, is discarded. Then the cleaned-text is imported into the corpus software #Lancsbox (Brezina,2015) as it can automatically conduct the POS (part of speech) tagging by Treetagger and further corpus analysis. The total number of tokens and types in RC-PSC is 288,955 and 18,206, respectively. Secondly, the RC-PSC is taken as the research corpus, and the sub-corpus of Brown, Academic Writing (BR-AWC) as the reference corpus, which has

162,219 tokens and 15,461 types (see Table 1) to extract the “N + that” clause construction respectively by using the regular expression. The incorrect concordance lines are removed.

Table 1 The description of RC-PSC and BR-AWC

Corpus	Types	Tokens	TTR (types/token) ratio
RC-PSC	18,206	288,955	71%
BR-AWC	15,461	162,219	68%

Last but not least, the frequency of shell nouns is counted and standardized and then classified according to Schmid’s classification standard. Furthermore, the features of usage, semantic distribution, and stance construction of shell nouns in popular science discourse are analyzed compared with academic discourse.

4. Findings

4.1 Frequency of shell nouns

The “N + that” clause construction in RC-PSC and BR-AWC is extracted by using regular expressions. Then 186 and 171 concordance lines are selected respectively for further analysis after a manual check. The frequency and normalized frequency are presented in Table 2.

Table 2 Frequency and standardized frequency of shell nouns

RC-PSC		BR-AWC	
frequency	normalized frequency	frequency	normalized frequency
186	634	171	1041

The normalized frequency (per million)

It can be seen from Table 2 that there are differences between RC-PSC and BR-AWC in terms of the frequency of shell nouns. Generally speaking, the standardized frequency of shell nouns in RC-PSC is relatively lower than that in BR-AWC, with nearly 60.9% of the latter.

The reason for this phenomenon may be that the popular science discourse presents the internal characteristics and external representations of things in a more specific way by providing concrete and vivid descriptions or using rhetorical devices to improve the readability of texts, thus achieving the purpose of popularizing scientific knowledge for the public. Differently, the academic discourse tends to use more formal and abstract language to summarize the rules and process of things or events. Therefore, the frequency of abstract nouns, such as shell nouns, in academic discourse is higher than that in popular science discourse.

Table 3 Shell nouns List

Shared shell nouns (21)	fact; hope; view; fear; claim; doubt; belief; reason; danger; theory; opinion; feeling; evidence; question; indication; suggestion; possibility; impression; knowledge; information; assumption
RC-PSC (11)	idea; effect; proof; chance; warning; misconception; supposition; assurance; realization; guarantee; contention
BR-AWC (21)	news; sign; risk; notion; point; extent; proviso; assertion; suspicion; certainty; thought; problem; conclusion; finding; conviction; statement; confidence; premise; coincidence; axiom; pretence

According to Table 3, RC-PSC and BR-AWC have 21 shared shell nouns, such as *fact*, *evidence*, *belief*, *doubt*, etc., which indicates that popular science discourse and academic discourse have certain commonalities. They are both based on evidence and facts and tend to answer questions in the process of description and explanation (see examples 1-2).

Example 1: This was because of the grim **fact that** the old young salmon had been killed off by the spraying in 1954. (RC-PSC)

Example 2: The lower limit was determined by **the fact** that for smaller flow rates, the arc started to strike the anode holder instead of the porous graphic plug, and it became highly unstable. (BR-AWC)

To be more specific, the selection of shell nouns in RC-PSC differs from that of BR-AWC. In RC-PSC, there are a few shell nouns with distinct stylistic features, most of which are common abstract nouns such as *idea*, *effect*, *chance* and so on. In contrast, words including *promise*, *problem*, *concentration*, and *finding* are relatively more frequent in BR-AWC, indicating a stronger stylistic sense. In addition, the diction in BR-AWC is more formal, and synonyms are often used to achieve linguistic diversity. For example, the shell noun *idea* in RC-PSC can be substituted by *thought*, *notion*, *point*, *statement* and so on in BR-AWC.

4.2 Semantic distribution of shell nouns

Schmid (2000: 88) categorizes shell nouns into the following six categories, namely, factual shell nouns, referring to describing facts, states of affairs; mental shell nouns, used for express ideas, cognitive states, and processes; linguistics shell nouns, expressing utterances, linguistic acts and produces thereof; modal shell nouns for depicting possibilities, abilities, permission, obligation, etc.; eventive shell nouns involving semantic features of activities, processes and states, circumstantial shell nouns referring to situation, times, location, manners of doing things and conditions for doing the thing. According to the above-mentioned classification, the present study extracts all shell nouns in RC-PSC and BR-AWC and then classifies them into the following types in order to explore their semantic distribution in these two different discourses (see Table 4).

Table 4 Semantic distribution of shell nouns

Semantic category	RC-PSC		BR-AWC	
	Shell nouns	Proportion	Shell nouns	Proportion
Factual	5	15.6%	5	11.9%
Linguistic	6	18.8%	10	23.8%
Mental	16	50%	21	50%
Modality	1	3.1%	2	4.7%
Eventive	N/A	N/A	2	4.7%
Others	4	12.5%	2	4.7%

It can be observed in Table 4 that the shell nouns in RC-PSC cover four types of semantic categories, while the shell nouns in BR-AWC involve five types of semantic categories, indicating that academic discourse embraces linguistic diversity in lexical choices. Apart from that, the semantic distribution in both corpus is roughly the same, and the mental shell nouns account for the highest proportion, both 50%, words like *belief*, *view*, *opinion*, *theory*, *doubt*, and *hope* included. Linguistic shell nouns rank second in terms of proportion percentage, 18.8% in RC-PSC and 23.8% in BR-AWC, including expressions such as *fact*, *reason* and *event*. The eventive and modality shell nouns are used less frequently because both corpora have scientific characteristics and seldom describe specific events and emotional attitudes. The above-mentioned semantic distribution may be due to the following two reasons. Firstly, popular science discourse aims to convey some scientific theories, beliefs and viewpoints to the public, and the academic writing concerning humanities and social science in Brown corpus tends to emphasize theoretical framework and authoritative viewpoints. Therefore, mental and linguistic shell nouns are the most. Secondly, both popular science discourse and academic discourse about humanities and social science are on the basis of factual evidence to show the scientific nature, but without specific experimental steps and result as in science and engineering academic discourse. Therefore, the proportion of factual shell nouns is smaller than that of eventive and modality shell nouns.

4.3 Stance-construction of shell nouns

Biber et al. (1999: 972) argues that shell nouns usually express two standings, including epistemic stance and attitudinal stance. The former refers to comments on the nature of propositional information in terms of certainty, authenticity, and accuracy, such as *assignment*, *theory*, and *proposition*, while the latter refers to personal attitude and emotion towards propositional information, such as *problem*, *limitation*, *improvement* and so on. Based on the above-mentioned classification, this paper classifies and compares the shell nouns in the two corpora (see Table 5).

Table 5 Stance construction of shell nouns

Corpus	Epistemic stance	Attitudinal stance	Total
RC-PSC	23	9	32
BR-AWC	34	8	42

It can be seen from Table 5 that in both corpora, shell nouns are often used to express an epistemic stance rather than an attitudinal stance. But In RC-PSC, there are 23(71.9%) shell nouns expressing epistemic stance and 9 (28.1%) expressing attitudinal stance, 32 in total. And in BR-AWC, 34 shell nouns express epistemic stance, accounting for 81.0% of the total, and 8

shell nouns express attitudinal stance, accounting for 19% of the total. It shows that there are fewer shell nouns expressing attitudes in academic discourse compared with popular science discourse. This is because the academic discourse should be more objective and cannot integrate personal emotions and attitudes.

5. Conclusion

This study demonstrates a corpus-based approach to explore shell nouns in “N + that” construction in popular science discourse, aiming to find out the features of their frequency usage, semantic distribution, and stance construction by means of making a comparative analysis between a self built popular science corpus(RC-PSC), four novels of Rachel Carson included, and the academic writing corpus, a sub-corpus of Brown corpus.

It has been found that firstly, the frequency of shell nouns in popular science discourse is relatively higher than that in academic discourse because popular science texts are not only popular science but also literary, so it is necessary to improve the readability of texts by means of vivid descriptions and rhetorical devices. Secondly, academic texts cover a wider range of semantic categories than popular science texts. In general, the semantic distribution of popular science texts and academic texts are roughly the same; mental and linguistic shell nouns occupy the majority in both corpora, while eventive and modality shell nouns are less frequent. Thirdly, shell nouns marking epistemic stance are more frequent than those signifying attitudinal stance in both corpora due to the genre and register features, objective and scientific nature involved. Besides, shell nouns expressing attitudinal stance in academic corpora are lesser than that in popular science texts because academic writing pays more attention to objectivity and does not integrate personal feelings and attitudes.

This is one of the first, if not the only, attempt to study shell nouns in “N+that” construction” in popular science discourse, so it fills the research gap to some extent. Admittedly, the size of both corpora is relatively small, so a more comprehensive analysis can not be conducted. Therefore, using a large size of the corpus in research is the direction for future studies. In addition, the paper only focuses on shell nouns in popular science discourse. Hence, shell nouns in other genres of discourse, such as media discourse and political discourse, can be explored in the future.

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