A Study of Adjective Types and Functions in Popular Science Articles

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Abstract

This study aims to analyze adjective types and functions found in popular science articles. 25 articles were randomly selected to analyze by employing the conceptual framework of adjective types in English by Khamying (2007). The findings reveal that ten types of adjectives including descriptive, proper, quantitative, numeral, demonstrative, possessive, distributive, emphasizing, exclamatory, and relative were found in the articles. The first five ranks of adjective types, which frequently used were hierarchically ordered from the descriptive adjectives (66.51%), the possessive adjectives (7.69%), the quantitative adjectives (7.57%), the demonstrative adjectives (5.26%), and the cardinal numeral adjectives (5.20%). The exclamatory adjectives were ranked as the least in use and the interrogative adjectives were not found in this study.

Keywords: Adjective types and functions, Popular scientific articles, Pop science

1. Introduction

Popular scientific articles are reading materials for general readers. In the educational sense, this kind of article "can make science more accessible to students, and so can play a useful role in the teaching of scientific writing as well as in the teaching of science" (Parkinson & Adendorff, 2004, p. 379). However, the scholars and researchers in the field are less interested in it even though research articles in science have been studied since the late of 19th century (Parkinson & Adendorff, 2004). The existing research on popular science writing are varied in focuses such as establishing an image of a science writer based on writing models or theories (Yore, Hand, & Prain, 2002), writing stylistics in popular science (Whelan, 2009), making visual images in popular science articles and science journalism in terms of communicative functions and cultural meaning (Hornmoen, 2010), examining a corpus of texts in popular science articles (Hyland, 2010), scientific discourse (Orellana, 2012), a scientific epistemology, an influence of its roles in society, and a writing improvement (De Ridder, 2014). Parkinson and Adendorff (2004), for example, studied the use of popular science articles in teaching scientific literacy in terms of comparing the discourse features of popular science with research articles and textbooks. The results found that the popular articles are useful for students because they are more accessible than textbook. The popular articles can also be generalized and utilized in the wide communities because of the vast number of specific scientists who transmit the world knowledge to ordinary people. On the other hand, textbooks are narrower and limited to a few exceptional people in the textbook field. Another example is Hyland's study (2010). He conducted a study on constructing proximity in relating to readers of popular and professional science. The term 'proximity' refers to the control of a writer in designing rhetorical features to show "both authority as an expert and a personal position towards issues in an unfolding text" (Hyland, 2010, p. 116). The purpose was to study how writers in research papers and popular science articles created a sense of proximity by textually constructing themselves and readers as having shared interests and understandings. The results show that the popular science proximity was used to make research accessible for non-specialists to uncover the scientific knowledge which was excluded in the professional papers. For the scientific research writers, they supposed themselves as competent colleagues who presented the familiarity in research methods and a disciplinary literature and supported claims with evidences.

The present study aims to explore other rhetorical features of academic articles, focusing on the use of adjectives in popular science articles with particular purposes to study its types and functions. From these aims, two research questions are raised.

1) What types of adjectives do the popular science writers use in their articles?

2) How adjectives are used in the popular science articles?

To answer these research questions, some conceptual frameworks are taken into account for shaping and crediting the validity and reliability of the ways in designing the research methodology, analyzing the research findings, and discussing the important issues.

2. Conceptual Framework

The notion of adjective has been raised in "the definitions of traditional grammars and dictionaries which represent adjectives as complementary types of modifier: an adjective modifies a noun" (Payne, Huddleston & Pullum, 2010, p. 31). Regarding Pustet (2006), "adjectives can be defined at various of the organization of language, in particular, at the levels of morphosyntax, semantics, syntactic usage" (p. 60). For the morphosyntax perspective, languages mostly have no independent class of adjective. Each lexicon can be combined with any types of grammatical items when it is used in syntactic context by investigating the position from other constituents in the higher-order syntactic configurations. Adjectives, in terms of semantic sense, refer "to express property concepts" (Pustet, 2006, p. 61). From this point of view, it shows the distinguished features which are different from other parts of speech, nouns and verbs, "whose most prototypical representatives denote object concepts and event concepts, respectively" (Pustet, 2006, p. 61). Lastly, adjectives in the syntactic sense are considered as functions which consist of two aspects: attributive and predictive functions. According to Quirk et al. (1985), "adjectives are attributive when they pre-modify the head of a noun phrase; likewise, they are predicative when they function as subject complement or object complement" (p. 417). Specially, "adjectives are subject complement not only to noun phrases, but also to clauses" (Quirk et al., 1985, p. 417) which probably include finite or non-finite clauses. Adjectives can be an object complement to clauses which mostly functions to express "the result of the process denoted by the verb…by using the verb *be*" (Quirk et al., 1985, p. 417). Adjectives sometimes can also be postpositive. That is to say, three positions of adjectives are considered. As examples provided by Quirk et al. (1985, p. 418),

Predicative: This information is *useful*.

Attributive: *useful* information.

Postpositive: something *useful*

Quirk et al. (1985) also claim four common features of adjectives (p. 402 - 403):

1) They can freely occur in attributive function (i.e. they can pre-modify a noun, appearing between the determiner, including zero article and the head of a noun phrase).

   Ex. an ugly painting, the round table

2) They can freely occur in predicative function (i.e. they can function as subject complement or object complement).

   Ex. the painting is *ugly*.

   He thought the painting *ugly*.

3) They can be pre-modified by the intensifier *very*.

   Ex. the children are very happy.

4) They can take comparative and superlative forms. The comparison may be by means of inflections (-er and -est) or by the addition of the pre-modifiers *more* or *most* (periphrastic comparison).

Ex. The children are *happier* now.

These students are *more intelligent*.

From these four features of adjectives, they can be sub-divided into eleven types (Khamying, 2007). The following table demonstrates its specific types, functions, and examples.

Table 1. Eleven Types of Adjectives in English (Khamying, 2007, p. 174 - 179)

No.	Types	Functions	Examples
1	Descriptive Adjective	To attribute or qualify people, animals, things, or places in order to describe its features	The **rich** man lives in the **big** house.
2	Proper Adjective	To modify noun in terms of the nationality, this type is originated from proper noun.	He employs a **Chinese** book.
3	Quantitative Adjective	To modify noun for particular details in quantifying	He ate **much** rice at school yesterday.
4	Numeral Adjective	To modify noun for particular details in exact quantifying which is divided into three perspectives: cardinal number (exact quantity), ordinal number (hierarchical number), and multiplicative number (double number)	1) Cardinal Numeral adjective Ex. My hand has **five** fingers. 2) Ordinal Numeral adjective Ex. I am the **seventh** son of my family. 3) Multiplicative adjective Ex. Some roses are **double**.
5	Demonstrative Adjective (this, that, these, those)	To show the noun it modifies is singular or plural and whether the position of the noun is near or far from the person who is speaking or writing	I invited **that** man to come in.

6	Interrogative Adjective	To modify noun as a questioning form	**What** book is he reading in the room?
7	Possessive Adjective	To express possession of a noun by someone or something	This is **my** table.
8	Distributive Adjective	To modify noun by dividing or separating into different parts	**Every** soldier is punctually in his place.
9	Emphasizing Adjective	To modify noun by highlighting or emphasizing the texts	Supansa is my **own** girl-friend.
10	Exclamatory Adjective	To modify noun by using interjection words	**What** a man he is!
11	Relative Adjective	To modify noun and combine sentence which are related between the first and second sentences	Give me **what** money you have.

Functionally, Halliday (1994) claims that the clause in English is combined by three different structures which derive from three different functions (metafunctions): ideational, interpersonal, and textual. These three structures serve to express semantic choices. He states:

> Transitivity structures express representational meaning: what the clause is about, which is typically some process, with associated participants and circumstances; mood structures express interactional meaning: what the clause is doing, as a verbal exchange between speaker-writer and audience; themes structures express that organization of the message: how the clause relates to the surrounding discourse, and to the context of situation in which it is being produced. These three sets of options together determine the structural shape of the clause (p. 180)

Adjectives in the sense of functional linguists include the nominal group in the transitivity structures. Halliday uses the term 'experiential structure of the nominal group' to explain word class in the nominal group. There are four functional elements of nominals: deictic (specific and non-specific), numerative (quantitative and ordinative), epithet (subjective expression and objective property), and classifier. The example is shown in Table 2,

Table 2. Experiential structure of part of a nominal group (Halliday, 1994, p. 180)

those	two	splendid	old	electric	trains
Deictic	Numerative	Epithet 1	Epithet 2	Classifier	Thing

This study employs the eleven types of adjectives in English by Khamying (2007) to categorize data in order to answer the research questions. The underlying reasons, for

selecting Khamying, is that he synthesizes the concept of English grammar into the local Thai textbook style and contributes to the Thai educational context. His textbook has become popular among Thai educators because it is easy to understand and apply. In this way, the results of the study are probably useful for a Thai EFL context and other EFL contexts in terms of raising awareness on the importance of popular science articles in education and its written styles, particularly the use of adjective types in the articles.

To conclude, this section briefly explains the overall conceptual framework of adjectives in order to set up a scope of the study in terms of analyzing data and discussing its findings. The following section elaborates more about procedures in conducting research.

3. Research Methodology

The aims of this study are to analyze adjective types and functions found in popular scientific articles. A mixed - method research was employed. The quantitative data were used to demonstrate the overall statistical numbers of the data. The qualitative data were applied to interweave the quantitative data for answering the research questions. The data were gathered from 25 popular scientific articles. Details of a nature of popular scientific articles, data collection procedures and analysis are explained as follows:

3.1 The Nature of Popular Scientific Articles

Popular scientific articles are reading materials for inexpert readers. The writers particularly consider "the reader as a person with a good all-round education, but with no specialized knowledge and no exceptional passion for the discipline" (http://awelu.srv.lu.se/genres-and-text-types/writing-in-academic-genres/popular-science-writing/). The scope of the writing is broad-ranging which is presented in many forms such as books, films and television documentaries, magazine articles, and web pages. The writers might be professional science journalists or scientists (McRae, 1993). The purposes in producing the popular science articles are "to inform and convince scientific outsiders (sometimes along with scientists in other fields) of the significance of data and conclusions and to celebrate the results" (McRae, 1993, https://en.wikipedia.org/wiki/Popular_science). This kind of writing functions in society in terms of uncovering the scientific findings by "driving technological innovation, informing political decision-making and policy-building, and sometimes even by affecting people's self-image and worldview" (De Ridder, 2014, p. 23). This study selected the popular science articles because the researcher purposed to investigate another dimension of the adjective use in the scientific work in order to discover its rhetorical choices. The benefits will be reflected for academicians in the field, educators, and students, especially when making language teaching and learning materials.

3.2 Data Collection Procedures and Analysis

This study randomly selected 25 articles which contain 14 285 words from the popular science and the scientific American websites. Referring to the former website, the main contents consist of five themes, including spacex, mars, snowden invention awards, and other miscellaneous topics (e.g. blogs, features, barrier, breakers, extreme science, a future without canner, videos, and our podcast). The latter website consist of ten main themes: the sciences,

mind, health, teach, sustainability, education, video, podcasts, blogs, and store. All selected articles were printed out and highlighted all adjective words. The ways to highlight words was to follow the adjective classification concept of Khamying (2007). The procedure was to analyze word by word of each sentence in the articles. The researcher then categorized its types into groups and analyzed functions of each sentence. Lastly, she discussed the findings with some relevant theories (Quirk et al., 1985; Halliday, 1994; Pustet, 2006; Khamying, 2007; Payne, Huddleston & Pullum, 2010) to discover the authentic situation of adjectives used in popular science articles.

4. Findings and Discussion

This section demonstrates the findings and discussions according to the research purposes.

From 25 popular science articles, the total of words is 14 343, but only 1 768 adjectives (12.32%) were found. These adjectives were categorized into ten types based on the eleven types of adjective classifications by Khamying (2007). The following table demonstrates the findings.

Table 3. Ten adjective types found in the findings

No.	Type of Adjectives	Percentage (100%)	Rank
1	Descriptive	66.51%	1
2	Proper	5.09%	6
3	Quantitative	7.57%	3
4	Numeral (Cardinal)	5.20%	5
	Numeral (Ordinal)	1.07%	8
5	Demonstrative	5.26%	4
6	Possessive	7.69%	2
7	Distributive	0.62%	9
8	Emphasizing	2.14%	7
9	Exclamatory	0.05%	11
10	Relative	0.33%	10

Regarding Table 3, the first five ranks of adjective types which were frequently used are hierarchically ordered from the descriptive adjectives (66.51%), the possessive adjectives (7.69%), the quantitative adjectives (7.57%), the demonstrative adjectives (5.26%), and the cardinal numeral adjectives (5.20%). The exclamatory type was regarded as the least frequently used in the articles (0.05%). However, the interrogative type was not found in these 25 articles. These ten categories are not only shown the adjective types, but also shown their functions in the clauses. In order to see the real phenomena of the functions, the first five ranks of the adjective types are used as examples for discussion. They are respectively discussed with examples and theoretical concepts.

Firstly, the results of this study show that the popular science writers mostly use descriptive adjectives to express their scientific knowledge to the readers. According to Khamying

(2007), the function of descriptive adjectives is to attribute or qualify people, animals, things, or places in order to describe its features. This adjective type is positioned in front of a noun, "appearing between the determiner, including zero article and the head of a noun phrase" (Payne, Huddleston & Pullum, 2010, p. 31). It functions as a premodifier (Khamying, 2007) or a complementary type of modifier (Payne, Huddleston & Pullum, 2010). In other words, it is called 'attributive function' (Quirk et al., 1985; Pustet, 2006). Two examples are extracted from two popular science articles. The former one is entitled, '*A Squirt of Stem Cell Gel Heals Brain Injuries*' by Ravindran (2009). It was published on the popular science website.

> Scientists have developed a gel that helps brains recover from <u>traumatic</u> injuries. It has the potential to treat <u>head</u> injuries suffered, in combat, <u>car</u> accidents, falls, or <u>gunshot</u> wounds. Developed by Dr. Ning Zhang at Clemson University in South Carolina, the gel is injected in <u>liquid</u> form at the site of injury and stimulates the growth of <u>stem</u> cells there (http://www.popsci.com/scitech/article/2009-09/squirt-stem-cell-gel-heals-brain-injuries).

The latter one is entitled, '*Can Big Data Help Psychiatry Unravel the Complexity of Mental Illness*? by Makin (2016). It was published on the scientific American website.

> <u>Brain</u> science draws legions of <u>eager</u> students to the field and <u>countless</u> millions in dollars, euros and renminbi to fund research. These endeavors, however, have not yielded <u>major</u> improvements in treating patients who suffer from <u>psychiatric</u> disorders for decades (http://www.scientificamerican.com/article/can-big-data-help-psychiatry-unravel-the-complexity-of-mental-illness/)

From these two extracts, the underlying words are the descriptive type, which are located in front of nouns and function as a modifier. Looking through the perspectives of systemic functional grammar, the descriptive adjectives in this extract are labelled as 'classifiers' (Halliday, 1994).

Secondly, the possessive adjective is regarded as the second most frequently used (7.69%) in the popular science articles. Its function is to express possession of a noun by someone or something (Khamying, 2007). Its features are in the same form as possessive pronoun (i.e. my, your, their, his, her). Halliday (1994) calls this type of adjective as specific deictic, especially in determinative functions. One extract from an article, entitled '*As a Teacher, How Can I Help My Students Develop Their Brains*?' by Willingham (2016) is taken to be an example. The underlying words are the possessive adjectives.

> I suggest that we not talk about the brains of <u>our</u> students but rather <u>their</u> behavior. After all, if we figured <u>out</u> some ways to improve <u>their</u> brains – increase the volume of specific regions, say, or the number of interconnections – but we saw no change in <u>their</u> ability to succeed at <u>their</u> actual schoolwork, we would not be satisfied (http://www.scientificamerican.com/article/as-a-teacher-how-can-i-help-my-s

tudents-develop-their-brains/)

The third type of adjective, which is frequently used, is the quantitative adjective (7.57%). The function is to modify nouns for particular details in quantifying (Khamying, 2007). Halliday (1994) calls this type as a numerative which functions as quantitative definite or indefinite. Here is an example extracted from an article, entitled '*Parents and Adult Children: Mutually Irritating Family Dynamics Often Fraught with Tension, Study Shows*' by Allen (2009). The quantitative adjectives are highlighted as an underlying form which can be seen mostly in a comparative form by adding the pre-modifier 'more'. This feature is related to one of the four common features of adjectives by Quirk et al. (1985). They contend that adjectives "can take comparative and superlative forms. The comparison may be by means of inflections (-er and -est) or by the addition of the pre-modifiers more or most (periphrastic comparison" (p. 402).

> Unsurprisingly, the survey of nearly 500 American parents and their age-22-and older offspring revealed that the touchiest issues were "lifestyle choices": whom we date, our money habits, our housekeeping savvy. Parents reported <u>more</u> tensions with daughters than sons. And daughters and sons noted <u>more</u> issues with Mom than Dad. Birditt suggests that this is because women tend to pursue <u>more</u> intimate relationships with <u>more</u> frequent contact – thus <u>more</u> opportunity for things to get ugly (http://www.popsci.com/scitech/article/2009-05/parents-and-adult-children-mu tually-irritating)

The fourth type is the demonstrative adjectives (5.26%). This type functions as a noun modifier either in singular or plural form and whether the position of the noun is closer or farther from the person who is speaking or writing (Khamying, 2007). This type in the systemic functional grammar is also called 'specific deictic' which functions as determinative or interrogative demonstration (Halliday, 1994). Here is an example from an article, entitled '*As a Teacher, How Can I Help My Students Develop Their Brains?*' by Willingham (2016). It was published on the scientific American website. "There is probably some truth in <u>that</u> statement – some thinking skills are quite general. But in practice, enhancing them has proved" difficult (http://www.scientificamerican.com/article/as-a-teacher-how-can-i-help-my-students-develop -their-brains/).

The fifth type is the cardinal number. Its function is to modify nouns for particular details in exact quantifying (Khamying, 2007). In systemic functional grammar, this type is called 'numerative', which functions as a definite quantitative (Halliday, 1994). The example is extracted from the article, entitled ' *2 Plausible Things That Cannot Both Be True: Your daily dose of number theory weirdness*' by Lamb (2016). The article is published on the scientific American website.

> There are <u>25</u> primes less than <u>100</u> and <u>168</u> less than <u>1,000</u>. It seems difficult for me to believe that they are places along the number line where the primes bunch up enough to make up for those very dense areas, and that's why the

k-turple   conjecture   seems   so   reasonable (http://blogs.scientificamerican.com/roots-of-unity/2-plausible-things-that-can not-both-be-true/).

What has been described is the overall findings of the research and a discussion of some points to answer the research questions. Another important point, which should be considered, is about how these types of adjectives help the popular science writers express or share their scientific knowledge to non-specialist readers. There are three points. First, the popular science articles are expected to be simple and direct because the purpose of this article type is to make research accessible for non-specialists to uncover the scientific knowledge which is excluded in the professional academic papers (Whelan, 2009; Hyland, 2010). This article's practical application in society is examining scientific findings by "driving technological innovation, informing political decision-making and policy-building, and sometimes even by affecting people's self-image and worldview" (De Ridder, 2014, p. 23). From this point of view, the relationship between adjective functions and the popular science articles' purposes are considered. That is to say, the scientific writers need to write their articles to be simple, direct, persuasive, accessible, and imaginable. For these purposes, scientific writers need adjectives as a tool to decorate a simple and meaningful language for transferring knowledge to general readers; otherwise, the articles might cause a problem with communciation. As Whelan (2009) states, "complex language can also be a way of fudging, perhaps unconsciously, to hide the fact that we aren't sure exactly what we mean" (p. 88). Hence, the results of the study found that the descriptive adjectives work to attribute or qualify people, animals, things, or places in order to describe its features (Khamying, 2007) were frequently used in the articles. The research reflects writers' rhetorical choices, which means these types of adjectives help the writers to meet their writing needs.

Secondly, Parkinson and Adendorff (2004) assert that "popular texts function as narratives of research, reporting on new knowledge claims not yet endorsed as fact by the research community" (p. 388). Their assertion is possibly related to the findings of the study, which shows the possessive adjective was the second most frequently used adjective in the popular texts, and the demonstrative adjective was the fourth one. Popular science writers have to narrate or report their scientific knowledge. For this reason, it is important to use the possessive adjective to express their own ideas and to use the demonstrative adjective to modify their expression in a meaningful way. This point might be a little bit ambiguous because other types of adjectives are also more or less supported in this matter. However, the discussion attempts to explain the fuctions of frequently using each particular type of adjective. In this way, only the frequent ones are taken into discussion.

Lastly, the findings reveal that there are no interrogative adjectives found in the articles. This is probably because the nature of the article is to narrate or report knowledge (Parkinson & Adendorff, 2004). Regarding Whelan (2009), "Popular science pieces must be written in a clear and direct style, so that any hard work by the reader comes from understanding the concepts, not fighting their way through the sentences" (p. 88). Therefore, the feature of these texts do not require the reader to question the reading materials.

5. Conclusion

Popular science texts are reading materials suitable for non-specialist readers who want to gain scientific knowledge. Popular science texts are different from research texts in many aspects such as stylistic features and purposes. However, the texts will be accessible and meaningful to readers depending on language use and whether it is attractive, readable, and accessible to them or not. The purposes of this study were to study rhetorical choices of adjectives types and functions in popular science articles. Adjective classification types of Khamying (2007) were employed to categorize data. Other relevant theoretical concepts (Quirk et al., 1985; Halliday, 1994; Pustet, 2006; Khamying, 2007; Payne, Huddleston & Pullum, 2010) were utilized for supporting the discussion findings in order to observe the phenomena of using adjectives in popular science articles. The findings found ten types of adjectives in the articles. Descriptive adjectives were the most frequently used adjective types in the articles. Possessive adjectives were second, and quantitative adjectives were third. Exclamatory adjectives were the least used, and interrogative adjectives were not found in this study. The phenomenon of this study corresponds with several theoretical concepts of adjective functions and popular science articles' purposes.

6. Limitations and Implications

The findings of this study include two primary limitations. First, the volume of popular science articles used in this study were limited. Further studies should add more data in order to increase the validity and reliability of the findings. Second, the notion of adjective has long been controversially discussed. Thus, the concept can be framed within a variety of conflicting perspectives. However, this study specially utilized Khamying's (2007) distinct model of adjective classification. Although some limitations are presented in the study, the findings are still useful in terms of contributing the importance of the popular science articles in education and the importance of using adjectives in scientific writings. The readers are also expected to discover and understand the current phenomena of the popular science articles and get some ideas to apply the texts with the appropriate activities or assignments in their classroom or situation.

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