

The Word-Formation Processes and Meanings of Compound Words in *National Geographic* Magazine Articles

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ABSTRACT

This study examines compound words and their semantic relations and interprets the meanings of the newly coined compound words found in *National Geographic* magazine's January to June 2019 issues. This study uses qualitative methods to analyze the data. It classifies compound words using Delahunty & Garvey's theory (2010) into five types: compound noun (CN), compound verb (CV), compound adjective (CA_{adj}), compound adverb (CA_v), and neoclassical compound (NCC). It also analyzes the semantic relations of compound words. The results of the study show that 241 compound words were found. The most common type of compound words was compound nouns (59.75%), followed by neoclassical compounds (18.67%), compound adjectives (15.35%), compound verbs (4.98%), and the least common type is compound adverbs (1.24%). The study also shows that 70.54% of the compound words found belong to endocentric compounds, and the remaining 29.46% to exocentric compounds. In addition, six newly coined and theme-related compound words were found. The meanings of these newly coined compound words are not available in referenced dictionaries.

Keywords: *compound word, semantic relation, endocentric compound, exocentric compound, National Geographic Magazine.*

INTRODUCTION

As time goes by, the development of language continues to grow, and language is the most critical aspect of human life, primarily for communicating with one another. Because of human influence, such as social conditions, the culture of a nation, and interference of many various languages, language always develops its word formations and meanings. As time goes by, there will be various discoveries and inventions that need a term to name them, which is one reason why words will continually develop.

One way of creating new words is by compounding. According to Yule (2010), compounding is a combining process of two separate words to produce a single form. Combining two words or more in a different form can express new meanings. It can be done if two or more morphemes or a simpler lexeme are joined as a word that has a new meaning according to the context of the sentence in which it is located.

The term "compound word" is different from other combined words, such as phrases. However, as their structures are similar, Indonesian readers/

learners cannot easily identify the problem of combined words, including compounds (Moehkardi, 2002). To comprehend the formation and the meaning of the compound word, we need to analyze them not only syntactically but also morphologically and semantically. Therefore, understanding the processes and meanings of English compounds is necessary not only to understand English compound vocabulary but also to form new possible compounds. *National Geographic* was selected as the data source of this research. It was chosen because it primarily presents new discoveries in areas such as science, history, geography, nature, and world culture. From the stories of these new discoveries, the magazine introduces many new terms used to convey the discoveries. The more exploration is carried out and presented in the magazine's articles, the more terms and words are created, including compounding.

Based on the background, the present study addresses the following questions:

1. What are the most frequent forms of compound words found in *National Geographic* magazine's 2019 issues?
2. What are the most frequent types of semantic relations of compound words found in *National Geographic* magazine's 2019 issues?

By analyzing the compound words found in *National Geographic*, the researchers expect to support the findings of earlier research and to contribute to the wider community of the newly-coined compounds by analyzing their structures and their meanings.

LITERATURE REVIEW

Some studies have been made on the types and processes of compound words. For example, Damayanti and Malini (2020) investigate the structure of compound words used in a book of poems called *Seventy-Seven Thousand Service-Trees* by Sri Chinmoy. This research adopted Booij's (2007) and McCarthy's (2001) theory. The study showed that out of the 390 compounds found, 348 belong to compound nouns, 20 to compound adjectives, and 22 to compound verbs. The study also reported two ways in which compound words are spelled: solid

and hyphenated. Furthermore, in terms of semantic relations, the study reported three types of relations: endocentric, exocentric, and copulative compounds.

Another study by Nurazizah and Nazhafah (2018) examines English compound words in a *Republika* news article based on O'Grady's theory to describe the compound words in terms of the form or composition of the compounds and Palmer's theory to describe the meaning of the words. The results of this study show that out of the 11 compound words found, seven belong to noun compounds, one to an adjective compound, and three to verb compounds. Based on their meanings, 10 compound words have transparent meanings and four opaque meanings.

Another study on compound words by Rahayu et al. (2016). The research discusses the compound words which are found in five selected articles in the BBC News. The data were analyzed using three combined theories by Bauer (1983), McCarthy (2002), and Plag (2009). The study found 201 compound words. 171 belong to compound nouns, 18 to other forms of compounds, six compound verbs, three compound adjectives, and three neoclassical compounds.

The present study differs from the other two previous studies in two ways. In contrast to Damayanti and Malini's research, the present research focuses more on scientifically derived compound words, whereas the other two studies on news articles. The present research focuses on specific topics and themes; thus, hopefully, the derived, newly coined compounds will enrich the list of compounds in those specific areas.

THEORETICAL FRAMEWORK

This study adopts Delahunty and Garvey's theory, which classified compounds into five types: compound nouns (CN), compound verbs (CV), compound adjectives (CA_{adj}), compound adverbs (CA_v), and neoclassical compounds (NCC). Delahunty and Garvey (2010) distinguish at least three different semantic relations between the head

and modifier(s) of compounds: endocentric compounds, exocentric compounds, and coordinative compounds. However, in this research, coordinative compounds are treated either as endocentric or exocentric compounds (Lieber, 2015).

Compound Words

Compound words are created by combining two or more words together to create another word (Delahunty & Garvey, 2010, p. 75). According to McCarthy (2002), compound words are formed by combining roots and the much smaller category of phrasal words, that is, items that have the internal structure of phrases but function syntactically as words.

Compound words can be quite similar to phrases because they are formed from the same word combination. However, there are enough cases to show the distinction between compounds and phrases. First, it can be seen from the difference in sound corresponding to the difference in meaning. The stress pattern of the compound word is usually different from the stress pattern in the phrase composed of the same words in the same order. In the compounds, the main stress is on the first word, while in the phrases, the main stress is on the last word (Delahunty & Garvey, 2010, p. 133). For example, the expression *black board* literally means ‘a board that is black’, while *blackboard* means ‘a board for writing on’. In the first expression, the main stress is on ‘board’, while in the second, the main stress is on ‘black’. The expression *black board* can be classified as a phrase because it has the characteristic of a phrase to be stressed on the last word. On the other hand, the word *blackboard* is classified as a compound because of the stresses on the first element.

The second criterion used to distinguish compounds from phrases is semantic: a compound tends to have a meaning that is more or less idiosyncratic or unpredictable (McCarthy, 2002, p. 60), while the meaning of a phrase is generally predictable from the meanings of its constituents. For example, a *blackbird* is a species of bird, regardless of its color; a *black bird* is a bird that is black, regardless of its species. A *trotting-horse* as a hyphenated compound is a kind of horse, regardless of its current

activity. The phrase *a trotting horse* indicates a horse that is currently trotting.

Third, in many compounds, the order of the constituent words is different from that in the corresponding phrase (Delahunty & Garvey, 2010, p. 133):

Compound	Phrase
sawmill	mill for sawing
sawing horse	a horse for sawing
sawdust	dust from sawing

Fourth, compound nouns allow no modification to the first element. This contrasts with noun phrases, which do allow modification to the modifier: compare **a really-blackbird* and *a really black bird* (Delahunty & Garvey, 2010, p. 133).

Syntactic Classification

There are several ways of approaching the study and classification of compound words, the most accessible of which is to classify them according to the part of speech of the compound and then sub-classify them according to the parts of speech of its constituents (Delahunty & Garvey, 2010, p. 133). Delahunty & Garvey (2010) classified compounds into five types of compound words: compound nouns, compound verbs, compound adjectives, compound adverbs, and neoclassical compounds.

Compound nouns

- a. Noun + noun: bath towel; boy-friend; death blow
- b. Verb + noun: pickpocket; breakfast
- c. Noun + verb: nosebleed; sunshine
- d. Verb + verb: make-believe
- e. Adjective + Noun: deep structure; fast-food
- f. Particle + noun: in-crowd; down-town
- g. Adverb + Noun: now generation
- h. Verb + particle: cop-out; drop-out
- i. Phrase compounds: son-in-law

Compound verbs

- a. Noun + verb: sky-dive
- b. Adjective + verb: fine-tune

- d. Particle + verb: overbook
- e. Adjective + Noun: brown-bag

Compound adjectives

- a. Noun + adjective: card-carrying; childproof
- b. Verb + adjective: fail-safe
- c. Adjective + Adjective: open-ended
- d. Adverb + Adjective: cross-modal
- e. Particle + Adjective: over-qualified
- f. Noun + noun: coffee-table
- g. Verb + Noun: roll-neck
- h. Adjective + noun: red-brick; blue-collar
- i. Particle + Noun: in-depth
- j. Verb + verb: go-go; make-believe
- k. Adjective/Adverb + verb: high-rise;
- l. Verb + particle: see-through; tow-away

Compound adverbs

- a. uptightly
- b. cross -modally

Neo-classical compounds

- a. astro-naut
- b. hydro-electric
- c. mechano-phobe

Semantic Classification

An alternative approach is to classify compounds in terms of the semantic relationship between the constituents—the modifying constituent and the modified head of the compound. The head of a compound is the constituent modified by the compound's other constituents (Delahunty & Garvey, 2010, p. 134). In compounds, the head is the element that serves to determine both the part of speech and the semantic kind denoted by the compound as a whole (Lieber, 2015, p. 47). In English, the heads of compounds are typically the rightmost constituent (excluding any derivational and inflectional suffixes). For example, in *traffic-cop*, the head is *cop*, which is modified by *traffic*; in *line-backer*, the head is *backer*, which is modified by *line*

(Delahunty & Garvey, 2010, p. 135).

On the other hand, McCarthy (2002) categorized compounds based on their meanings into headed compounds and headless compounds. According to McCarthy (2002), headed compounds would be regarded as having an internal 'centre'. Ingo Plag (2002) describes a compound that has an internal headword as an endocentric compound. Meanwhile, the word class of headless compounds is not determined by any element inside them or having a 'centre' outside themselves, and this is called an exocentric compound (McCarthy, 2002, p. 65).

Delahunty and Garvey (2010) distinguish at least three different semantic relations between the head and modifier(s) of compounds: endocentric compounds, exocentric compounds, and coordinative compounds:

Endocentric Compound

An endocentric compound is a compound word that denotes a subtype of whatever is denoted by the head. That is, the head names the type, and the compound names the subtype. These are called endocentric compounds (Delahunty & Garvey, 2010, p. 135). For example, An *armchair* represents a type of chair; a *breath-test* represents a kind of test. A *traffic-cop* is a kind of cop; a *teapot* is a kind of pot; a *fog-lamp* is a kind of lamp; a *blue-jay* is a kind of jay.

Exocentric Compound

An exocentric compound is a compound word that denotes a subtype of a category that is not mentioned within the compound. The compound names a subtype, but the type is not represented by either the head or the modifier in the compound. For example, *dead-head*, *redhead*, and *pickpocket* represent types of people by denoting some distinguishing characteristics. There is typically another word, not included in the compound, that represents the type, and the compound represents the subtype. In the case of *deadhead*, *redhead*, and *pickpocket* this other word is person, so a *deadhead* is a person who is an enthusiastic fan of the band *The Grateful Dead*. These are called exocentric compounds (Delahunty & Garvey, 2010, p. 135).

METHODS

The data of this research were taken from all theme-related articles that appeared in six issues of *National Geographic* from January to July 2019. Each issue presents one particular topic. For example, the January issue presents “The Future of Medicine”. The data were collected from the sentences that contained compound words found in the title, the caption of the pictures, and the body of the articles. Advertisements were excluded. The first step used in this study for collecting the data was by closely reading the articles and paying attention to each sentence that contains compound words. After that, the researchers underlined the compound words whose meanings were related to the topic of each issue (medicine, technology, nature, environment, social, etc.). The theme-related compound words were listed based on each topic of the selected issues of *National Geographic*.

The researchers then classified the compound words into their types following Delahunty and Garvey’s theory (2010). They then searched for their meanings in the dictionary, identified their word classes, and identified their semantic relations. The dictionaries used were *Oxford Online Dictionary*, *Cambridge Online Dictionary*, and *Merriam-Webster Online Dictionary*. The collected data were analyzed using qualitative methods and descriptively presented based on the theory applied in the study.

RESULTS AND DISCUSSION

Altogether, 241 compound words were found related to the topics of the six issues of *National Geographic* from January to July 2019. Table 1 below shows the frequency of compound words found in the data source.

Table 1 shows that 144 (59.74%) compound words belong to compound nouns, 12 (4.98%) to compound verbs, 37 (15.35%) to compound adjectives, three (1.24%) to compound adverbs, and 45 (18.67%) to neoclassical compounds. The results of this study support Damayanti and Malini (2020), who also found compound nouns to be the most frequent (Damayanti & Malini, 2020).

Table 1. The frequency of compound words in the January-July 2019 issues of *National Geographic*

No.	Compound Category	Token	%
1.	Compound noun	144	59.75
2.	Compound verb	12	4.98
3.	Compound adjective	37	15.35
4.	Compound adverb	3	1.24
5.	Neoclassical compound	45	18.67
Total		241	100.00

Table 2 shows the frequency of semantic relations found in the data source. Based on the meanings of the compounds, Delahunty and Garvey (2010) classify the semantic relations of compound words into endocentric, exocentric, and coordinative. The table shows that 170 (70.54%) compound words belong to the endocentric compound category and 71 (29.46%) to the exocentric compound category.

Table 2. The frequency of the semantic relations of compound words in the January-July 2019 issues of *National Geographic*

No.	Semantic Relations	Token	%
1.	Endocentric	170	70.54
2.	Exocentric	71	29.46
Total		241	100

Compound Word Formations and their Semantic Relations

Compound Nouns

As shown in Table 1, 144 compound words belong to compound nouns. The most dominant subtype of the compound nouns in this research is Noun + noun combination with 78 compound nouns, followed by Adjective + Noun combination with 45 compounds, verb + Noun combination with 8 compounds, Particle + Noun combination with 6 compounds, Noun + Verb with 5 compounds and the last verb + Particle with 2 compounds. Below are some samples of Noun + Noun compounds and other subtypes of compound nouns in their respective sentences.

- (1) Noun + Noun: *Brainchild* (CN/NG-02/Tech)

As I travelled to the dusty villages abutting the Salar de Uyuni—Colchani, Tahua, Chilitaico, Llica—occasional signs of support for Morales would materialize on public walls: “Evo Si!” But on the subject of Morales’s lithium **brainchild**, residents responded with a weary scepticism, sometimes tinged with worry. (National Geographic “The ultimate climb”, February 2019, p. 103)

The morphological process of *brainchild* is the word *brain* (N), which is then combined with *child* (N). According to Cambridge Online Dictionary (n.d.), the word *brain* means the organ inside the head that controls thought, memory, feelings and activity. Then, the meaning of *child* is a person from the time of birth until he/she becomes an adult (Oxford Learner’s Dictionaries, n.d.). The meaning of the compound *brainchild* is not the brain of a child, but it refers to a new invention or an idea (Oxford Learner’s Dictionaries, n.d.). Because the meaning of *brainchild* is different from its literal meaning, the word *brainchild* can be classified as an exocentric compound.

(2) Verb + Noun: *Jumpsuit* (CN/NG-02/Env)

Smokejumpers often make their own **jumpsuits**, heavily padded and with plenty of pockets to hold gear. (National Geographic “Leonardo”, May 2019, p. 135).

The word *jumpsuit* as a compound noun is a combination of *jump* (V) and *suit* (N). The word *jump* means to move off the ground or away from a surface by pushing the body with legs and feet, while the word *suit* means a set of clothes that covers both the upper body and the legs worn in a particular situation or while doing a particular activity (Merriam-Webster Online Dictionary, n.d.). The compound word *jumpsuit* was originally formed in the early 1940s as a coverall suit by parachutists for jumping (Merriam-Webster Online Dictionary, n.d.). Because the head of the compound *jumpsuit* is the word *suit*, and the meaning can be taken literally from the modifier *jump*, it can be concluded that this

compound is an endocentric compound.

(3) Noun + Verb: *Blood work* (CN/NG-01/Med)

The catheter was changed at about 5:30 p.m. and was followed by an ultrasound and **blood work**. (National Geographic “The future of medicine”, January 2019, p. 129)

Blood work is a noun compound that is formed from two elements, *blood* (Noun) and *work* (Verb), that is written separately without a hyphen. The word *blood* means a red liquid that flows through the bodies of humans and animals, and the meaning of *work* is doing something that involves physical or mental effort as part of a job (Cambridge Online Dictionary, n.d.). Those words create a new word *blood work*, which means a diagnostic test of blood to find out if a person has any medical condition (Cambridge Online Dictionary, n.d.). From that definition, no lexeme can become the head and dominate the meaning of the whole word. Therefore, the word *blood work* can be classified as an exocentric compound.

(4) Adjective + Noun: *Microchip* (CN/NG-05/Tech)

We’re doing it with delicate **microchips** and massive machines. (National Geographic “Leonardo”, May 2019, p. 20)

The morphological process of the word *microchip* is derived from *micro* (Adj) and combined with *chip* (N). The word *micro* means something very small or at the lowest level. Meanwhile, the word *chip* means a very small piece of semiconductor, especially parts of a computer that contain extremely small electronic circuits and devices and can perform particular operations (Oxford Learner’s Dictionaries, n.d.). The word *microchip* means a very small piece of material that is a semiconductor used to carry a complicated electronic circuit or related to electronic computation (Oxford Learner’s Dictionaries, n.d.). Because the definition of the word *microchip* can be seen from the word *chip* as the head and explained

more by its modifier *micro-*, the word *microchip* can be categorized as an endocentric compound.

Compound Verbs

Table 1 shows that 13 compound words belong to compound verbs. The most dominant subtype of compound verbs is the Noun + Verb combination with six compounds, then the Adjective + Verb combination with four compounds, the Particle + Verb combination with two compounds, and the Adjective + Noun combination with one compound. Below are some examples of compound verbs.

(5) Noun + Verb: *Breastfeed* (CV/NG-01/Med)

Langston Emile Johnson was born at 2:33 p.m. on April 12, 2016. The scheduled C-section seemed routine, and Kira was able to **breastfeed** just after giving birth. (*National Geographic* “The future of medicine”, January 2019, p. 128)

The word *breastfeed* is a compound verb from the combination of the words *breast* (Noun) and *feed* (verb) written without a hyphen. The word *breast* means a part of a woman’s body that produces milk when she has had a baby (Merriam-Webster Online Dictionary, n.d.). Meanwhile, the word *feed* means to give food to a person (Merriam-Webster Online Dictionary, n.d.). The word *breastfeed* in this context means to give somebody (baby) food (in this context milk) that is produced from the woman’s breast (Merriam-Webster Online Dictionary, n.d.). The definition of *breastfeed* can be taken literally from its head (*feed*) and its modifier *breast*. Therefore, this compound is an endocentric compound that is right-headed.

(6) Particle + Verb: *Outmaneuver* (CV/NG-04/Med)

As genome mapping becomes increasingly available, it now costs under \$2,000. Clinicians have a unique insight into a patient’s medical destiny, and perhaps the opportunity to **outmaneuver** mutated genes. (*National Geographic* “Cities”, April 2019, p. 50)

The word *outmaneuver* is derived from *out* (Particle) and *maneuver* (Verb). The word *out* in this context means greater, better, or more than something else. Meanwhile, the word *maneuver* means to handle and move something carefully or

with difficulty. The word *outmaneuver* means gaining an advantage over by skillful or clever maneuvering (to maneuver more effectively). The definition of *outmaneuver* can be taken literally from its head (*maneuver*) and its modifier *out*, and thus it can be classified as an endocentric compound.

Compound Adjectives

As shown in Table 1, 37 compound words were classified as adjective compounds. The most dominant subtype of compound adjectives is the Adjective + Noun combination, with a total of 12 compounds. The other subtypes of compound adjectives are Noun + Adjective combinations with 11 compounds, Adjective + Adjective combinations with four compounds, Noun + Noun combinations with five compounds, Adjective/Adverb + Verb combinations with three compounds, and verb + Adjective combinations with one compound. Below are some examples of compound adjectives.

(7) Noun + Adjective: *Eco-friendly* (CAAdj/NG-05/Env)

I’ve lingered at these intersections, observing the innovations: digital memorials on social media, **eco-friendly** green burial options, and even interactive tombstones. (*National Geographic* “Leonardo”, May 2019, p. 50)

The word *eco-friendly* is formed by combining two words, namely the word *eco* (noun) and the word *friendly* (adjective). These two words are connected by a hyphen creates a compound word *eco-friendly*. This compound belongs to an adjective compound since it has an adjective as its head and in the context, it is used to describe the noun. The word *eco* means related to the environment. Meanwhile, *friendly* means behaving in a pleasant or kind towards something (Merriam-Webster Online Dictionary, n.d.). *Eco-friendly* in this context has a meaning of something that is not harmful or something that is kind to the environment (Merriam-Webster Online Dictionary, n.d.). By that definition, the meaning of the word *eco-friendly* can be determined from its constituents. Therefore, it can be classified as an endocentric compound because the head (*friendly*) expresses the core meaning of the compound and is explained more by the modifier (*eco*).

- (8) Verb + Adjective: *Run-down* (CAAdj/NG-04/Soc)

Millions of soldiers had come home from World War II to overcrowded, **run-down** cities; their new families needed a place to live. (*National Geographic* “Cities”, April 2019, p. 85)

The word *run-down* is a compound that belongs to the adjective compound and is formed from two elements: *run* (verb) and *down* (adjective). It belongs to the adjective compound since it is used to describe the noun *city*. The word *run* means moving faster than a walk, and the word *down* means reduced or low in activity, frequency, or intensity (Oxford Learner’s Dictionaries, n.d.). Those two words create a new word, *run-down*, which means something that is in very bad condition or has not been taken care of (Oxford Learner’s Dictionaries, n.d.). From that definition, no lexeme can become the head and dominates the meaning of the whole word. Therefore, the word *run-down* can be classified as an exocentric compound.

- (9) Adjective + Adjective: *Blue-green* (CAAdj/NG-06/Env)

I revel in the sensation and am thrilled to see tiny bubbles of oxygen, a by-product of photosynthesis, rise to the surface and join the oxygen produced by trillions of diatoms, **blue-green** bacteria, and other phytoplankton in the surrounding ultraclear water. (*National Geographic* “The hidden cost of wildlife tourism”, June 2019, p. 140)

The word *blue-green* is an adjective compound formed from two elements of color, *blue* (adjective) and *green* (adjective). The word *blue* means a kind of color that is the same as the color of the sky without clouds on a bright day. Meanwhile, *green* means a color between yellow and blue that is the same as the color of grass (Cambridge Online Dictionary, n.d.). The word *blue-green* is considered an adjective compound since it is formed from adjectives, and in the position of the sentence, it is used to describe the noun *bacteria*. The word *blue-green* means a color between blue and green in the spectrum (Cambridge Online Dictionary, n.d.). Because both elements from the word *blue-green* are heads and each contributes equally to the meaning of the whole

word, the word *blue-green* can be classified as a copulative compound.

- (10) Noun + Noun: *Test-tube* (CAAdj/NG-01/Med)

In 1978 the first “**test-tube**” baby, Louise Brown, also triggered anxiety about designer babies. (*National Geographic* “The future of medicine”, January 2019, p. 67)

The word *test-tube* is a noun compound formed from two words, *test* (noun) and *tube* (noun). The word *test-tube* in the article functions as a modifier describing the noun *baby*. According to Oxford Learner’s Dictionaries (n.d.), the word *test* means a medical examination to check the condition of health. Meanwhile, the word *tube* means a hollow object in the shape of a pipe or tube. These words create a new word *test-tube*, which means a procedure to produce a baby from an egg that was fertilized outside of a woman’s body and then put back into the woman’s body to finish developing (in-vitro fertilization) (Merriam-Webster Online Dictionary, n.d.). It is called *test-tube* because the embryo is formed in the test-tube instead of the woman’s fallopian tube. From that definition, the lexeme is the head and dominates the meaning of the whole word. Test-tube is a kind of tube. Therefore, the word *test-tube* can be classified as an endocentric compound.

- (11) Verb + Noun: *Breakneck* (CAAdj/NG-04/Soc)

China’s **breakneck** urbanization is all the more remarkable for having been preceded by Mao Zedong’s Cultural Revolution, which sent millions of people the other way, from cities into the country. (*National Geographic* “Cities”, April 2019, p. 88)

The word *breakneck* is a compound word derived from the words *break* (verb) and *neck* (noun). It belongs to the noun compound, but it is used to describe the noun *urbanization*. The word *break* means separating something into two or more parts as a result of force (Oxford Learner’s Dictionaries, n.d.), while the word *neck* means a part of the body between the head and the shoulders. Meanwhile, the word *breakneck* has a meaning of very fast and dangerous (Merriam-Webster Online Dictionary, n.d.). In this case, the meaning is related to the high rate of urbanization in China, which is increasingly fast. Because the definition of *breakneck*

cannot be defined from its literal meaning, the compound word can be classified as an exocentric compound.

- (12) Adjective + Noun: *Multi-herb* (Cadj/NC-01/Med)

To date, PHY906 has been used in eight human trials alongside different chemotherapy drugs and radiation to treat colorectal, liver, and pancreatic cancers, Peikwen tells the audience. “We are hopeful that PHY906 will become the first FDA-approved, **multi-herb** drug” (*National Geographic* “The future of medicine”, January 2019, p. 115).

The compound word *multi-herb* is a word combination of the words *multi* (adjective) and *herb* (noun). The word *multi* means many or more than one. Meanwhile, the word *herb* is a type of plant whose leaves, flowers, or seeds are used for particular dishes or in making medicine (Oxford Learner’s Dictionaries, n.d.). *Multi-herb* is a combination of more than one herb. It consists of a mixture of various herbal plants. In this context, PHY906 is one of the *multi-herb*, which is a mixture of four herbs (*National Geographic*, January 2019). Because the definition of *multi-herb* can be taken from its literal meaning, the compound word *multi-herb* can be classified as an endocentric compound.

- (13) Adjective/Adverb + Verb: *High-rise* (CAj/NG-04/Env)

Verdant Victoria Peak overlooks **high-rise** towers in densely populated Hong Kong. Photographer Nicolas Ruel connects both views in one image. (*National Geographic* “Cities”, April 2019, p. 8)

The compound word *high-rise* is a combination of the words *high* (adjective) and *rise* (verb). The word *high* means a large distance from top to bottom or a long way above the ground, or having the stated distance from top to bottom, and the word *rise* means to move upwards or become higher. Meanwhile, the word *high-rise* has the same meaning as tall, and it is used to describe a building with many floors (Oxford Learner’s Dictionaries, n.d.). The word *high-rise* in this context refers to the towers that are high and have many floors. Because the definition is different from its literal meaning, and the meaning cannot be taken literally from its

head (*rise*) and explained further with the existence of its modifier (*high*), the word *high-rise* can be classified as an exocentric compound.

Compound Adverbs

Table 1 shows that three compound words belong to the compound adverb category. Below are some examples of compound adverbs found in the data source.

- (14) Adjective + Adverb: *Free-solo* (CAv/NG-02/Soc)

I’ve climbed this slab myself, and the thought of doing it **free-solo** makes me nauseated. (*National Geographic* “The ultimate climb”, February 2019, p. 48)

The word *free-solo* is an adverb compound that is formed from the words *free* (adjective) and *solo* (verb). The word *free-solo* as an adverb compound can be seen from its position in the sentence that modifies the verb *doing*. The meaning of the word *free* in this context is to climb without rope and only use artificial aids (such as pitons) used for protection against falling and not for support to climb. Meanwhile, the word *solo* in this context means climbing alone (Merriam-Webster Online Dictionary, n.d.). The word *free-solo* means climbing (mountain) without the use of artificial aids or safety equipment (Merriam-Webster Online Dictionary, n.d.). The word *free-solo* has *solo* as the head and *free* as the modifier. From the context, the word *free-solo* can be classified as an endocentric compound because the meaning can be taken literally from the head (*solo*) and explained further by its modifier (*free*).

Neoclassical Compounds

As shown in Table 1, 45 compound words were classified as neoclassical compounds. Neoclassical compounds were found to be the second most commonly used compounds in the *National Geographic* magazine. This is because neoclassical compounds are usually used to designate scientific or technical concepts, as in *National Geographic*, that mostly discuss science and technology. Below are some examples of neoclassical compounds used in the magazine.

(15) *Otoscope* (NCC/NG-01/Med)

With smartphone **otoscopes**, parents can look in kids' ears and share the view with a pediatrician. (National Geographic "The future of medicine", January 2019, p. 30)

The compound *otoscope* is formed from *oto-* and *-scope*. *Otoscope* is written as one word to avoid ambiguity. The word *otoscope* is formed by two combining forms. The initial combining form (ICF) in this compound is *oto-* since it occupies the initial position of the compound, while *-scope* is considered as the final combining form (FCF). The combination of the words *oto* and *-scope* forms a neoclassical compound *otoscope*.

According to Merriam-Webster Online Dictionary (n.d.), the word *oto-* is derived from the Greek word *ot*, meaning ear, and *-scope*, meaning an instrument for viewing or observing. An *otoscope* is an instrument used for visual examination of the tympanic membrane (eardrum) and ear canal (Merriam-Webster Online Dictionary, n.d.). The meaning of *otoscope* can be predicted from the meaning of its elements. Therefore, the word *otoscope* can be classified as an endocentric compound.

(16) *Electrocardiogram* (NCC/NG-01/Med)

Apps and sensors can enable a phone to take electrocardiograms to check for dangerous arrhythmias; software and a microphone can equip it to "listen" to a cough and diagnose pneumonia. (National Geographic "The future of medicine", January 2019, p. 30)

The compound word *electrocardiogram* is a word combination of *electro-* and *cardiogram*. The word *electro-* in the compound word is considered an initial combining form (ICF), whereas the word *cardiogram* is considered a noun derived from the words *cardio-* and *-gram*. According to Merriam-Webster Online Dictionary (n.d.), *electro-* means electricity derived from New Latin *electricus*, and *cardiogram* means a drawing that shows a record of the heart's activity. If *electrocardiogram* is written as one word, it means a drawing that shows the electrical activity of the heart (Oxford Learner's

Dictionaries, n.d.). Based on the analysis of the meaning, the meaning of the word *electrocardiogram* can be determined from the meaning of its elements. Therefore, the word *electrocardiogram* can be classified as an endocentric compound.

Newly Coined Compound Words

This study found a number of compound words cited by *National Geographic* to convey information about its further exploration. The following compound words are considered new because they are not found in any of the following reference dictionaries: Merriam-Webster Online Dictionary, Oxford Learner's Dictionaries and Cambridge Online Dictionary. Some examples of the new compound words are discussed below:

(17) *Chrononutrition* (NCC/NG-01/Med)

So, we need to override that craving-driven schedule and eat in a way— more early, less later—that aligns food patterns with our internal clocks. We call this **chrononutrition**. (National Geographic "The future of medicine", January 2019, p. 20)

The compound word *chrononutrition* is a combination of *chrono-* and *nutrition*. *Chrono-* is considered the initial combining form (ICF) derived from Greek *chrónos*, which means time. Meanwhile, according to Oxford Learner's Dictionaries (n.d.), *nutrition* means food that is metabolized in the body to grow and be healthy. Based on these meanings, it can be concluded that the meaning of *chrononutrition* is a relationship between the timing of food intake that can affect the metabolism of food in the body. The more complex definition of *chrononutrition* is a new discipline in medical science that not only explains how the timing of food intake and biological rhythms may affect health, metabolism, and nutrition but also how nutrition (composition and size of meal) may affect our internal clock system (Arola-Arnal et al., 2019).

In terms of its form, the word *chrononutrition* can be classified as a neoclassical compound. According to its semantic relation, the word *chrononutrition* can be classified as an endocentric

compound because the definition can be predicted from the meanings of its constituents.

(18) *Breakthrough starshot* (CN/NG-03/Tech)

Breakthrough Starshot is an ambitious plan in development to send tiny probes on a 20-year journey to the exoplanet Proxima Centauri b. But even a featherweight spacecraft needs fuel. (*National Geographic* “We are not alone”, March 2019, p. 45)

Breakthrough starshot is an open compound word combination derived from the words *breakthrough* (noun) and *starshot* (noun). According to Merriam-Webster Online Dictionary (n.d.), the word *breakthrough* means an important discovery, especially in knowledge or engineering. Meanwhile, *starshot* is a mini spacecraft or nanocraft which can travel up to 20 percent the speed of light (Loeb, 2015, p. 1). The word *breakthrough starshot* was first created in 2015 and announced to the public in 2016. *Breakthrough starshot* is a project discovery made by Breakthrough Initiatives to make ultra-fast light-driven nanocrafts (Loeb, 2015, p. 1). According to its morphological process, the word *breakthrough starshot* can be classified as a compound noun since it is formed by nouns, and the referent of the compound as a whole is also a noun. According to its semantic relation, the word *breakthrough starshot* is not a kind of starshot, but it refers to a project made by Breakthrough Initiative. Because of that, the word *breakthrough starshot* can be classified as an exocentric compound.

(19) *Starshade* (CN/NG-03/Tech)

Using a model, MIT astrophysicist Sara Seager demonstrates **Starshade**, under development at NASA’s Jet Propulsion Lab in Pasadena, California (*National Geographic* “We are not alone”. March 2019, p. 46).

The word *starshade* is derived from the words *star* (noun) and *shade* (noun). The word *starshade* can be considered a compound noun since it is formed from nouns, and based on the context, the word *starshade* belongs to a noun. The word *star*

means a self-luminous gaseous spheroidal celestial body of great mass that produces energy by means of nuclear fusion reactions. Meanwhile, the word *shade* means a shelter or a shield from the heat and glare of sunlight (Merriam-Webster Online Dictionary, n.d.). The complex definition of *starshade* stated by NASA is a kind of shade that is flower-shaped, consisting of 28 panels arranged around a central hub like a giant sunflower, more than a hundred feet in diameter (NASA, 2021). The *shade* will block a host star’s light. In other words, a *starshade* is a shade used to block a star’s light. Therefore, the word *starshade* can be classified as an endocentric compound because the meaning can be predicted from the meaning of its constituents. The word *starshade* can be classified as a compound noun since it is formed by nouns, and the referent of the compound as a whole is also a noun. The word *starshade* was first introduced in 2006 by NASA.

(20) *Technosignature* (CN/NG-03/Tech)

With increasing computational power and more sensitive telescopes, researchers are expanding the search to optical and infrared emissions, targeting the “**technosignatures**” of advanced civilizations. (*National Geographic* “We are not alone”, March 2019, p. 56)

Technosignature is a word combination of *techno-* as an initial combining form (ICF) and *signature*. The term “*technosignature*,” is a combination of “*technological signature*” or “signature of technology”. The word *techno-* is a combining form that is related to technology and the word *signature* (noun), which means something that serves to set apart or identify and also can be a characteristic mark (Merriam-Webster Online Dictionary, n.d.). The word *technosignatures* first appeared in the literature in an article by Jill Tarter entitled “The evolution of life in the universe: Are we alone?” (2006). *Technosignature* means any sign of technology that is used to infer the existence of intelligent life elsewhere in the universe, including familiar objects of searches for extraterrestrial

intelligence such as narrow-band radio signals or pulsed lasers (NASA, 2018). From its morphological process, the word *technosignature* can be defined as a compound noun, and according to its semantic relation, it is an endocentric compound because the meaning has a relation to each constituent.

(21) *Blue carbon* (CN/NG-06/Env)

These migrating hordes of small fish and invertebrates, the largest concentrations of animals on Earth, now figure prominently in climate science as “**blue carbon**” (*National Geographic* “The hidden cost of wildlife tourism”, June 2019, p. 140)

The word *blue carbon* is a combination of the words *blue* (adjective) and *carbon* (noun). The word *blue carbon* is considered a compound noun since it has a noun as its head, and in the data source, the compound belongs to a noun. The term *blue carbon* was first coined in 2009 by Nellemann et al. (2009) to describe the disproportionately large contribution of coastal vegetated ecosystems to global carbon sequestration.

The word *blue* means a kind of color which is the same as the sky color. Meanwhile, the meaning of *carbon* is a chemical that is found in all living things, existing in a pure state such as diamond and graphite (Oxford Learner’s Dictionaries, n.d.). The word *blue carbon* means an organic carbon that is captured and stored by the oceans and coastal ecosystems, particularly by vegetated coastal ecosystems: seagrass meadows, tidal marshes, and mangrove forests (Macreadie et al., 2019). As its name suggests, the carbon has a blue color because it is formed underwater. By that meaning, the word *blue carbon* can be classified as an endocentric compound because the meaning can be predicted from its elements.

(22) *Sponge-city* (CN/NG-04/Env)

Protecting upland water systems and rigorous collection and cleansing of stormwater improve water quality. Wet-land restoration and **sponge-city** measures revive habitats and

protect against flooding and sea-level rise (*National Geographic* “Cities”, April 2019, p. 28).

The word *sponge-city* is a combination of the words *sponge* (noun) and *city* (noun). The word *sponge-city* can be classified as a compound noun since it is formed by nouns, and the referent of the compound as a whole is also a noun. The word *sponge* means a piece of artificial or natural material that is soft and light and full of holes and can hold water easily (Oxford Learner’s Dictionaries, n.d.), while the word *city* means a large town (Cambridge Online Dictionary, n.d.). The word *sponge-city* was first launched by the Chinese Central Government in 2013. The word *sponge-city* means a city that is designed not to be impermeable but more like a sponge that absorbs rainwater (Zevenbergen, Fu, & Pathirana, 2018, p. 100). Therefore, the word *sponge-city* can be classified as an endocentric compound because the meaning of the compound can be determined from its constituent words.

CONCLUSION

The results of the study show that there are 241 compound words used in the January-July issues of *National Geographic*. Compound nouns were found to be the most dominant type of compounds, followed by neoclassical compounds, compound adjectives, compound verbs, and compound adverbs. For the semantic relations, the study shows that endocentric compounds were more commonly used than exocentric compounds. Furthermore, six newly coined and theme-related compounds were found.

The fact that compound nouns were the most dominant compounds indicates that nouns are one of the most prominent parts of speech. They are usually used as the main word of a sentence. Moreover, the dominant use of neoclassical compounds also shows that loanwords from Greek are still being used and are often used as references in making new terms. This supports and is in accordance with the characteristic of *National Geographic*, which continues to reveal new discoveries, especially in the world of nature, technology, environment and society, which in this case, the Greek terms are often used as reference.

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