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ARTICLE

Categorization of Hyphenated Noun-Adjective and Adjective-Adjective Compounds in English: A Semantic Study of Word Complexing

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ABSTRACT

Despite their prevalence, internal semantic relations within English compound adjectives remain a relatively underexplored area in compounding research. This research aims to enhance our understanding of hyphenated Noun-Adjective compounds (hereinafter referred to as "HNAC") and hyphenated Adjective-Adjective compounds (hereinafter referred to as "HAAC") by revealing the patterns of internal semantic relations between the constituents of compounds. The HNAC and HAAC types of compound adjectives share common structural and semantic features. The existing categorizations of compound adjectives often rely on concepts such as subordinative, attributive, coordinative and copulative. Similarly, analyses of sense relations within compound adjectives frequently employ these same notions. This study integrates empirical data with systemic functional theories to elucidate the semantics of HNAC and HAAC, offering a complementary perspective. The dataset, comprising 716 HNACs and HAACs sourced from the online Oxford English Dictionary, is treated as a collection of word complexes. Drawing on the ideational metafunction and the model of taxis and logico-semantic relation of expansion within Systemic Functional Linguistics, the study investigates the internal semantic relations between the constituents of HNAC and HAAC. Data analysis results in the categorization of HNAC and HAAC into five prototypical types: hypotactic-elaborating compound, hypotactic-enhancing compound, paratactic-elaborating compound, paratactic-extending compound, and paratactic-enhancing compound. Furthermore, fourteen common patterns of internal semantic relations between the constituents of HNAC and HAAC are generalized using the theories of taxis and expansion. The findings demonstrate that the systemic functional theories provide a valuable framework for describing the morphological and semantic features of HNAC and HAAC.

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1. Introduction

Grammatically, a noun can be modified in English by elements preceding and following it. The words like *tobacco-brown*, *blue-green* in a *tobacco-brown suit*, and *blue-green hills* are hyphenated Noun-Adjective compound (hereinafter referred to as "HNAC") and hyphenated Adjective-Adjective compound (hereinafter referred to as "HAAC"), serving as the premodifiers to the noun head in the nominal groups (as "NP" in traditional grammar). This study focuses on the common patterns of internal semantic relations between the constituents of HNAC and HAAC that serve as premodifiers in context.

Not all hyphenated compounds are included in dictionaries illustrated with meaning and use. Hyphenated compound adjectives have not received due attention in the studies of compounding [1]. The meaning of hyphenated compound adjectives is not necessarily the combination of the meanings of their composition elements. For example, '*oil-rich* seeds' are seeds rich in oil. Here *rich* serves as an adjective, meaning 'having or containing an abundance of some specified thing' [2]. In contrast, 'tiny *oil-rich* countries' are small countries which derive much wealth from oil. Here *rich* means 'having much money or abundant assets; wealthy, moneyed, affluent' [3].

The categorization of hyphenated compound adjectives and the interpretation of the internal semantic relations between the constituents of HNAC and HAAC sourced from online Oxford English Dictionary (OED) are made by applying the theories of ideational metafunction and the model of taxis and logico-semantic relation of expansion within Systemic Functional Linguistics (SFL). The current study highlights that the SFL theoretical model for word complexing is efficiently supportive of our categorization of HNAC and HAAC and generalization of the internal semantic relations in HNAC and HAAC.

2. Literature Review

Regarding to the rich variety of compounds in English, due consideration has been given to the issues of definition of compounds [4–15], classification of compounds [7,13,16–19], the head [4,20–22], the stress [4,8,23–26], and the sense-relation between the constituents of compounds [7,27–32]. However, most issues mentioned here have not been resolved.

As to the semantics of HNAC and HAAC in grammar, the most analysed compounds are those with $[N+N]_N$ and $[A+N]_N$ or $[N+A]_N$ internal structure, whereas many other structural types have been almost ignored. According to Scalise and Bisetto, little attention has been paid to $[N+A]_A$, and $[A+A]_A$ compounds [33].

2.1. The Internal Semantic Relations Between the Constituents of HNAC and HAAC in Word-Formation

Two prominent propositions concerning the sense-relation between the constituents of compounds which have been made are Marchand's 'determinant-determinatum' structure [7], and Guevara and Scalise's four structures of a two-member compound (signaled as "1" , "2", "12", "0") [32].

The internal semantic relations between the constituents of N-A compounds and A-A compounds are not as extensive as that between the constituents in NN compounds. Bauer and Huddleston give five sense-relation patterns of the most productive N-A compounds and A-A compounds [14]. Examples for each pattern are from Bauer and Huddleston [14] (**Table 1**).

Conti makes the classification of N-A and A-A compound adjectives [16], following Marchand [7], into six major types, as shown in **Table 2**.

Lieber applies a lexical semantic approach to [N+N] compounds and argues that the analysis of N+N compounds "generalizes easily to the other types" [34]. Here we take the internal semantic relations between the constituents in NN compounds as guidelines to the discussion of the internal semantic relations between the constituents in N-A and A-A compound adjectives.

Table 1. Sense-Relation Patterns of N-A and A-A Compounds.

N	Sense-Relation Patterns	Relation	Examples
1	Comparative/ Intensifying	'A as N'	[N-A]: *bone-dry, crystal-clear, dirt-cheap, stone-deaf;* [N-A]: *bottle-green, brick-red, jet-black, steel-blue*
2	Measure terms	'A to the extent of N'	[N-A]: *ankle-deep, skin-deep, state-wide, week-long*
3	Incorporated complement/modifier	'N complements /modifies A'	[N-A]: *accident-prone, class-conscious, girl-crazy, oil-rich*
4	Coordinative	'A_2 and A_1'	[A_2-A_1]: *bitter-sweet, deaf-mute, syntactic-semantic*
5	Subordinative	'A_2 modifies A_1'	[A_2-A_1]: *dark-blue, icy-cold, pale-green, red-hot, white-hot*

Table 2. Major Types of N-A and A-A Compound Adjectives.

N	Types of Compound Adjectives		Examples
1	Subordinative compounds	Endocentric N-Adj patterns	Grading compounds: Color Intensifying	*salmon-pink; razor-sharp, ice-cold, brand-new*
2			Time & Space compounds	*knee-deep, sky-high, skin-deep*
3			Restrictive/specifying compounds	*family-friendly, alcohol-free*
4		Endocentric Adj-Adj patterns	Nuancing and intensifying	*milky-white; wide-awake*
5	Copulative compounds	Adj-Adj patterns	Appositional compounds	*red-blue, red-green, black-white*
6		Adj-Adj patterns	Coordinative (and Complementary) compounds	*sweet-sour, clever-stupid*

The internal semantic relations between the constituents in NN compounds are various. Jackendoff proposes two NN compound schemas (or constructions) [35]. The first is Argument schema: [N_1 N_2]=[Y_2 (..., X_1,...)] 'an N_2 by/of/ . . . N_1'; the second is Modifier schema: [N_1 N_2]=[Y_2 $^{\alpha}$;[F(...,X_1,..., α,...)]] 'an N_2 such that F is true of N_1 and N_2'. As to the range of possibilities for F in the schemas, Jackendoff makes a list of basic functions or relations, as shown in **Table 3** [35]. Lieber suggests that A+A coordinates have either a mixture interpretation (something which is *blue-green* is a color between blue and green) or a simultaneous interpretation (for example, *deaf-mute*) [36]. An exocentric A+A coordinate is possible when the two adjectives in question are semantically similar in some way and can either be given a 'relationship' or 'between' interpretation [36]. She treats A+A compound *funny-peculiar* as an attributive compound [36].

Bauer et al. claim that compounds can be divided into argumental and non-argumental compounds [18]. In argumental compounds, one element is interpreted as an argument of the other element. That is, either the head or the non-head constituent of the compound can be argument-taking. In non-argumental compounds, neither member bears an argumental relation to the other. Under non-argumental compounds, two major types of attributive and coordinative compounds are distinguished. The sense-relation between the first constituent and the second in attributive compounds is one of loose modification. There is a variety of internal semantic relations in coordinative compounds, but always ones in which both elements of the compound have equal semantic weight; in other words, where neither element can be said to modify the other. Importantly, the distinction between attributive and coordinative compounds is not always clear. For example, the attributive compound *police dog* refers to a dog working for the police or a dog trained as police force. The coordinative compound *scholar-athlete* refers to a person being a scholar and athlete.

Bauer et al. treat NA compounds as argumental compounds based on the claim that the adjective heads like *free, prone, or proud* are argument-taking adjectives as in *toll-free* [18]. That is, compound adjectives with nouns as the non-head constituent are generally argumental compounds. AA compounds in which both the non-head and head constituents are adjectives as in *blue-green* are coordinative non-argumental compounds [10]. Argumental relations in NA and AA compounds are shown in **Table 4**. Examples for each category are from Bauer et al. [18]. The internal semantic relations between the constituents of HNAC and HAAC in word-formation has not been made as explicit and specific as that of NN compounds. There is no statistical support for these findings.

Table 3. Basic Functions in Schemas of NN Compound [35].

N	Function F	Relation
1	CLASSIFY (X_1, Y_2)	'N_1 classifies N_2'
2	Y_2(X_1)	'(a/the) N_2 of/by N_1'
3	BOTH (X_1, Y_2)	'both N_1 and N_2'
4	SAME/SIMILAR (X_1, Y_2)	'N_1 and N_2 are the same/similar'
5	KIND (X_1, Y_2)	'N_1 is a kind of N_2'
6	SERVES-AS (Y_2, X_1)	'N_2 that serves as N_1'
7	LOC (X_1, Y_2)	'N_2 is located at/in/on N_1'
8	LOC_{temp} (X_1, Y_2)	'N_2 takes place at time N_1'
9	CAUSE (X_1, Y_2)	'N_2 caused by N_1'
10	COMP (Y_2, X_1,)	'N_2 is composed of N_1'
11	PART (X_1, Y_2)	'N_2 is part of N_1'
12	MAKE (X, Y, FROM Z)	'X makes Y from Z.' a. 'N_2 made by N_1'; b. 'N_2 made from N_1'
13	PROTECT (X, Y, FROM Z)	'X protects Y from Z.' a. 'N_2 protects N_1'; b. 'N_2 protects from N_1'

Table 4. Argumental Relations in NA and AA Compounds.

Category	Relation	Subcategory	Examples
Argumental compounds (X, Y)	either X or Y as an argument of the other	-	[N-A] *fat-free, divorce-prone, crime-prone, fraternity-proud, ankle-deep, butter-yellow, word-final, resource-expensive*
Non-argumental compounds (X, Y)	neither X or Y as an argument of the other	attributive compound adjective	-
		coordinative compound adjective	[A-A] *spicy-mild, icy-hot, blue-green*

2.2. Syntactic Approach to The Semantics of Compounding in The Generative Tradition

The theoretical arguments for and against treating syntax as a model for the exploration of morphology in Chomskyan generative tradition have enhanced the understanding of the similarities and distinctions between sentence structure and compounding morphology. The treatment of compounding within the framework of generative semantics is mainly a transformational line of analysis, either through corresponding to syntactic structure or phrase structure [20,27,28,37–39].

One prominent example is the theoretical use of the syntactic term 'head' [40] as a morphological one with definition that "head with respect to feature F" is the "rightmost element of the word marked for the feature F" [41]. The head rule includes two conditions: a) The syntactic category of H is consistent with that of AB; b) The referent of H is wider than that of AB [22]. Rong distinguishes between the syntactic head and the semantic head since "a) is the syntactic criterion and b) is the semantic criterion" [22]. Rong's proposition of "duplocephy (compounds containing two syntactic-semantic heads are named as duplocephy)" and "monocephy (compounds containing one syntactic-semantic head are named as monocephy)" [21] can solve the problem with the Right-hand Head Rule [20] when the two constituents of some appositional compounds are both heads. For example, in *learner-driver*, both 'learner' and 'driver' are syntactic-semantic heads [21]. Apart from the distinction between syntactic head and semantic head, the notion of 'draft head' can better explain the difference between two syntactic-semantic heads. Draft head refers to the constituent which is employed as the basis in encoding, or the constituent being directly modified [21,22]. In *learner-driver*, 'driver' is the draft head and the basis in encoding while 'learner' is not. Then, 'driver' is the syntactic-semantic-draft head, that is, the "3-in-1 head" [22].

One important proposition by Jackendoff is the Parallel Architecture which highlights the crucial role of interface rules in mediating the interactions between Phonological, Syntactic, and Semantic structures [42,43].

The studies of compounding through generative syntax do not provide the answer to the research questions on the semantics of HNAC and HAAC in the current study.

2.3. Systemic Functional Approach to HNAC and HAAC

We examine the categories and semantics of HNAC and HAAC, guided by the theories of ideational metafunction and the taxis and logico-semantic relation from Systemic Functional Linguistics.

2.3.1. Categorization of Hyphenated Compounds in Systemic Functional Grammar

In Systemic Functional Grammar, language is part of a "complex semiotic construct" which has two levels: content and expression [44]. They expand into four strata: semantics, lexicogrammar, phonology and phonetics. The grammar construes experience and organizes the construal into wording; this is the stratum of lexicogrammar. When humans use language, the grammar has to interface with the eco-social environment. Human experience is transformed into meaning; this is the stratum of semantics.

Lexicogrammatical category of HNAC and HAAC as adjective complexes. In SFL, a word group (simply called group) is an expansion of a word, and belongs to endocentric construction. "A group is in some respects equivalent to a word complex – that is, a combination of words built up on the basis of a particular logical relation" [45]. The premodifier accommodates wordrank groups, "compressed phrases or clauses" [45]. In the context of nominal group, it is safe to say that the hyphenated compound premodifier in question is a hyphenated group or hyphenated phrase with clear boundary, or a hyphenated clause, or a hyphenated word complex. The hyphenated group is generally hyphenated nominal group, such as *first-class* in *first-class honors*. The hyphenated phrase as premodifier generally refers to hyphenated prepositional phrase, such as *on-the-job* in *on-the-job training*. The hyphenated word complex as premodifier generally includes hyphenated noun complex and hyphenated adjective complex, such as *tractor-trailer* (referring to "something that consists of both a tractor and a trailer" [46], as interpreted by Jackendoff) and *yellow-green* in *tractor-trailer price*, *yellow-green color.*

Then the hyphenated group/phrase can be seen as downranked (downgraded) from group/phrase rank to word rank. The hyphenated word complex can be seen as shifted from word complex to word simplex. A special case is when

a clause serves as a single premodifier, then the hyphenated clause is seen as downgraded from clause rank to word rank. Among the types of hyphenated compound premodifiers, most hyphenated groups/phrases, and probably all hyphenated clauses are not lexicalized. This study focuses on lexicalized English HNAC and HAAC (such as *ice-cold*, *yellow-green*), which are lexicogrammatically hyphenated adjective complexes.

In SFL, a 'word complex' refers to a grammatical construction that consists of two or more words that are functionally related in a specific way. Expressions like *'pepper and salt', 'soup or salad', 'three thousand', 'very large'* are all word complexes. This concept is part of the broader framework of unit complexes, which also includes clause complexes, group complexes, and morpheme complexes. These complexes are structures that involve the repetition of a single variable, functioning as the realization of recursive systems [47].

Semantic category of HNAC and HAAC as simple qualities. Not like proper nouns, "common nouns are almost indefinitely expandable" [44]. By a lexicalized way, the noun takes up modifications. Modification refers to the generalized logical-semantic relation of subcategorization: 'a is a subset of x'. "The basis of the subcategorization ... shifts ... (from the right) ... to the left" [45].

Among the three metafunctions in SFL, the ideational metafunction is a resource for construing our experience. The grammar is ideationally a theory and interpretation of human experience, either external or internal. The ideational metafunction is further divided into experiential and logical metafunction. Four kinds of elements — process, participants in that process, circumstances related with the process, and relator — constitute a figure which is a configurational semantic unit represented by a clause. Participants are distinguished as 'simple' and 'macro'. Macro-participants (such as a clause rankshifted as a group) are all metaphorical. Simple participants may be things or qualities. Qualities and things constitute nominal groups. Some simple qualities are metaphorical; the rest of simple qualities are divided into qualities of expansion and qualities of projection [44]. Qualities of expansion "expands things they are related to by elaboration, extension or enhancement" [44]. For example, most descriptive adjectives (such as *plastic, wool, green, heavy*) are subtype attribution, qualities of elaboration. They are inherent properties of the thing they modify. Most HNAC and HAAC (such as *winter-cold, feather-soft, penny-grey*) act as a single modifier to the noun. They are semantically simple qualities.

2.3.2. Taxis and Logico-Semantic Relations of Expansion in Complex Structures

The highly generalized logico-semantic relations of expansion are manifested in many regions of the semantic system: in sequences, "in the organization of figures of being", and "in the taxonomy of 'things'" [44]. Halliday and Matthiessen explain meaning as expansion by saying that:

> *The regions of semantic space are opened up and defined by the three vectors of elaboration, extension and enhancement — elaborating a region that is already as it were staked out, extending the regions boundaries to take in more, and enhancing the region's potential by enrichment from its environment* [44].

There is interdependency between the two constituents of a construction which are linked by a logico-semantic relation. Parataxis and hypotaxis are two different degrees of interdependency. Hypotaxis is the relation (i.e., binding) between the dependent element(s) and the dominant element. The dominant element is free, and the dependent element(s) not. The hypotactic relation is logically non-symmetrical and non-transitive. The contrary relation is named as parataxis, which refers to the relation (i.e., linking) between "like elements of equal status", the initiating element and the continuing elements. Both of the initiating and the continuing elements are free. "The paratactic relation is logically" symmetrical and transitive, and it "can be exemplified with the 'and' relation". All 'logical' structures in language are "either paratactic or hypotactic" [45]. "Parataxis and hypotaxis are general relationships" which are applicable to not only clause complexes, but also to group or phrase complexes or word complexes [45]. This is the theoretical basis of logical proposition of parataxis and hypotaxis in the HNAC and HAAC of the current study, since the HNAC and HAAC can be analyzed into paratactic or hypotactic adjective complexes.

A clause complex is formed by means of tactic relations; one pair of clauses is built up as a chain, and "related by interdependency" [45]. The model of taxis and logico-semantic types of clause complexes developed in Systemic Functional Grammar as in **Table 5** shows how the symbols for taxis (for example, 1, 2, α, β) combine with those for logico-semantic relation types (=, +, ×) of expansion [45]. Projection is not included here since expansion rather than projection is related in the current study. The logico-semantic relation type symbol is placed before the number or letter representing the continuing clause in a clause complex. In hypotaxis, the secondary clause is the dependent one, which can either precede the dominant clause (+β ^ α) or follow it (α ^ +β) [45]. In SFG, the analysis of word complexes adheres to the same principles as those utilized for clause complexes.

Table 5. Model of Taxis and Logico-Semantic Types of Clause Complexes (Adapted from Halliday and Matthiessen [45]).

Relation		Paratactic	Hypotactic
expansion	elaboration	notation (1 =2) 1 John didn't wait; =2 he ran away.	notation (α = β) α John ran away, =β which surprised everyone.
	extension	notation (1 +2) 1 John ran away, +2 and Fred stayed behind.	notation (α +β) α John ran away, +β whereas Fred stayed behind.
	enhancement	notation (1 ×2) 1 John was scared, ×2 so he ran away.	notation (α ×β) α John ran away, ×β he was scared.

2.3.3. Taxis and Logico-Semantic Relations in Word Complexes

The logico-semantic relations of expansion that are manifested in word complexing fall into the same three types of expansion manifested in clause complexing. The systems of taxis and logico-semantic relation together function in defining the internal semantic relations between constituents of a word complex. They provide an important dimension for theoretical investigation of the internal organization of HNAC and HAAC in the current study.

The taxis and logico-semantic relations of expansion are manifested in the HNAC and HAAC, viz., the hyphenated adjective complexes. The theories of taxis and expansion apply to the logical structure and semantic analysis of HNAC and HAAC when the HNAC and HAAC are actually in logical terms hyphenated adjective complexes. They can explain the logico-semantic relations between the two constituents in HNAC and HAAC.

The model of taxis and logico-semantic types of clause complexes is adapted as the model of taxis and logico-semantic types of word complexes. A little difference is the placement. Generally, in hypotaxis in word complexes, the secondary constituent is the dependent one, which usually precedes the dominant constituent (+β ^ α); in parataxis in word complexes, the continuing constituent can either precede the initiating constituent (+2 ^ 1) or follow it (1 ^ +2). Projection is not manifested in word complexing. The logico-semantic relation type symbol is placed before the number or letter representing the secondary or continuing constituent in a word complex (**Table 6**). This model is referred to as the theoretical basis for the description of HNAC and HAAC in current research.

Table 6. Model of Taxis and Logico-Semantic Types of Hyphenated Word Complexes in Data.

Relation		Hypotactic	Paratactic
expansion	elaboration	notation (α = β) =β icy α cold	notation (1 = 2) =2 blue 1 green
	extension	-	notation (1 + 2) +2 sour 1 sweet
	enhancement	notation (α × β) ×β sheep α white	notation (1 × 2) ×2 rich 1 rich

Based on expansion, five types of taxis and logico-semantic relations between constituents of hyphenated word complexes are identified in the data: (1) In hypotactic-elaborating word complexes, being the traditional 'attributive' compound, the dependent constituent β is descriptive to the dominant constituent α. For example, *icy-cold*. (2) In hypotactic-enhancing word complexes, the dominant constituent is modified by the dependent constituent(s). For example, *sheep-white*. (3) In paratactic-elaborating word complexes, being the traditional 'appositional' compound, the continuing constituent(s) restate or particularize the initiating constituent. For example, *blue-green*. (4) In paratactic-extending word complexes, being the traditional 'coordinate' compound, the semantic relationship between the continuing constituent(s) and the initiating constituent is 'and, also, at the same time'. For example, *sour-sweet*. (5) In paratactic-enhancing word complexes, the semantic relationship between the continuing constituent(s) and the initiating constituent is 'and' incorporated with a circumstantial feature. For example, *rich-rich*. Hypotactic-extending word complexes, in which the dominant constituent is extended hypotactically by the dependent constituent(s), are not identified in the data.

This model is applied in interpreting the logical structure and semantics, identifying the common HNAC and HAAC patterns, and bringing out the linguistic features of HNAC and HAAC in English.

The SFL theories of ideational metafunction and the model of taxis and logico-semantic relation of expansion for word complexing offer an important alternative in the categorization of HNAC and HAAC and generalization of the internal semantic relations in HNAC and HAAC. They would bring out the morphological and semantic features of HNAC and HAAC in a systematic approach.

2.4. The Proposal of Research Questions

This study aims to elucidate the semantics of HNAC and HAAC through decoding the internal semantic relations between the constituents of HNAC and HAAC in context. Our specific research questions are as follows:

(1) How to categorize hyphenated Noun-Adjective and Adjective-Adjective compounds from a systemic functional perspective?

(2) What are the common patterns of internal semantic relations between the constituents of hyphenated Noun-Adjective and Adjective-Adjective compounds on the basis of taxis and logico-semantic relations of expansion?

The study adopts systemic functional theories of lexicogrammar and semantics in exploring the types of taxis and logico-semantic relations between the constituents of HNAC and HAAC, and the meaning of HNAC and HAAC, so that it facilitates the understanding and application of hyphenated compound adjectives in English.

3. Methodology

3.1. Descriptive Approach to The Grammar of HNAC and HAAC

Descriptive research of English grammar has been a tradition of linguistic studies for about 500 years [45]. Reference grammars — such as those by Jespersen, Quirk et al., Biber et al., and Huddleston and Pullum, along with the series of Halliday and Halliday & Mattheissen — are all descriptive grammars [5,13,45,48–52].

A descriptive grammar generally attempts to make a coherent treatment of how the whole language works, and give account of the essential features of a given language. The answers to the research questions lie in the grammatical theory. The theoretical model and framework developed from Systemic Functional Grammar can support the analysis and description of HNAC and HAAC, and the results of analysis can validate the theoretical model and framework.

With the guidance of the theoretical framework, the study employs corpus-assisted discourse analysis in categorizing HNAC and HAAC in English, addressing the first research question.

Addressing the second research question of describing the internal semantic relations between the constituents of HNAC and HAAC in English, descriptive approach allows the researcher to examine HNAC and HAAC as they occur naturally, to capture the nuances and variations that arise in real written communication, and provide an accurate representation of the actual language use.

In uncovering the internal semantic relations between the constituents of HNAC and HAAC, the research compared multiple theoretical models with the taxonomy of word complexes and the taxonomy of expansion [14,16,18,35,45]. By comparing multiple perspectives, the researcher can better identify the recurring patterns and regularities of HNAC and HAAC in the dataset, capture the complexities and variations of HNAC and HAAC inherent in English language, make descriptions with solid empirical foundation, and make systematic categorizations, thus enriching the overall findings and making them more applicable across diverse contexts.

The categorization of HNAC and HAAC and description of the internal semantic relations between the constituents of HNAC and HAAC can be accomplished through the application of the systems of taxis and logico-semantic relations in the ideational metafunction domain. The focus is on how independent words combine to create meaning through their interdependencies and logico-semantic relations of expansion.

3.2. Materials and Data Collection

Raw materials for the HNAC and HAAC dataset were sourced from the online Oxford English Dictionary (www.oed.com) and meticulously processed using marking and tagging techniques. The resulting data were stored in .xlsx and .docx formats.

The data collection meets two criteria. Firstly, the data collection aims to show evidence of actual HNAC and HAAC use in real texts in the English language. Secondly, the data collection aims to cover both the frequent and less frequent features of HNAC and HAAC in English, so as to ensure that the data produce adequate HNAC and HAAC.

The Oxford English Dictionary serves as a primary and authoritative data source for the English language. The online OED is a large corpus of English compound adjectives. According to the online OED Information, there are over 500,000 entries and 3.5 million quotations. Some compounds used to be subentries in the old online OED version, and they are all described as main entries in the new version [53]. When searching with one simple word, we find that compounds are listed in the ‘compounds & derived words’ section of the entry. In this section, with the option of ‘All compounds & derived words’, it shows a list of all the compounds and derived words formed from that word. The list can be ordered alphabetically or by date, and can be filtered by using the ‘Adjective’ under ‘Part of Speech’ and ‘Compound’ under ‘Type of formation’ in the left- hand panel. For compounds that have been upgraded to a main entry, there are information in several sections, including meaning and use, factsheet, etymology, and frequency. In meaning and use section, it may include one or more

meanings, with each meaning followed by a set of quotations ordered by date. Each quotation includes the quotation text where the compound was used, the time and the source information (author, title, page number, etc.).

The data sample includes hyphenated [Noun + Adj] compound adjectives, hyphenated [Adj + Adj] compound adjectives, the year of their first use in English language, some of their suggested meaning, and the quotation texts where the compound adjectives serve as premodifiers. All resources are from online OED, being 716 N-A and A-A compounds.

The marking and tagging of HNAC and HAAC have been done manually through Microsoft Word, Microsoft TXT, and Microsoft Excel, with the support of various data analysis tools.

Corpus-assisted discourse analysis is applied to validate the theories of ideational metafunction and the taxis and logico-semantic relation from SFL in explaining the meaning and the sense-relation between the constituents of HNAC and HAAC.

3.3. Data Analysis

At the first stage of the study, a preliminary sample analysis is conducted. We take a data sample of 215 to investigate the structure of HNAC and HAAC and the common patterns of HNAC and HAAC for guiding overall exploration of the data. The samples are analyzed for the internal structure of HAAC and HNAC.

At the second stage, data sample of 215 is analyzed for the semantic relations in HAAC and HNAC. In addressing the first research question, five categories of semantic relations between the constituents of HAAC and HNAC are identified.

At the third stage, 70% of total dataset including 91 HAAC and 410 HNAC is analyzed for the semantic relations in HAAC and HNAC, enhanced with the result of the analysis of 30% of total dataset at stage 2. In addressing the second research question, fourteen subcategories of semantic relations between the constituents of HAAC and HNAC are identified.

The HNAC and HAAC retrieved are grammaticized as words and fitted into the premodifying schema, as in *an age-long cultural tradition*, where *age-long* is Classifier; but in their (more) congruent form, as clauses or phrases, they occupy a special place in the group, as the Qualifier: *a cultural tradition with a long age/history* (phrase)/*having long history* (non-finite clause)/*which has long history* (finite clause).

4. Results

4.1. Prototypical Types of HNAC and HAAC

Based on the model of taxis and logico-semantic types of word complexes, the retrieved HNAC and HAAC in the data can be classified into five categories. The five prototypical types of taxis and logico-semantic relation within HNAC and HAAC are hypotactic-elaborating, hypotactic-enhancing, paratactic-elaborating, paratactic-extending, and paratactic-enhancing. The variant forms of sequence of the prototypical types of taxis and logico-semantic relations in HNAC and HAAC are shown in **Table 7**.

Accordingly, there are five categories of HNAC and HAAC, respectively, named as hypotactic-elaborating compound, hypotactic-enhancing compound, paratactic-elaborating compound, paratactic-extending compound, and paratactic-enhancing compound. Through detailed data analysis of the meaning and usage of 716 HNAC and HAAC in context, the productivity of five categories of HNAC and HAAC in the data is given in **Table 8**.

Table 7. Taxis and Logico-Semantic Types of HNAC and HAAC in the Data.

Relation	Prototypical Types	Notation	Variant Forms of Sequence
Taxis & logico-semantic relations	hypotactic-elaborating	‘α = β’	‘=β ^ α’
	hypotactic-enhancing	‘α × β’	‘×β ^ α’
	paratactic-elaborating	‘1 = 2’	‘=2 ^ 1’
	paratactic-extending	‘1 + 2’	‘+2 ^ 1’
	paratactic-enhancing	‘1 × 2’	‘×2 ^ 1’

Table 8. Productivity of Five Categories of HNAC and HAAC in the Data.

N	Categories	Construction	Instances	Percentage
i	hypotactic-elaborating compound	A-A	61	8.52%
ii	hypotactic-enhancing compound	N-A	590	82.40%
iii	paratactic-elaborating compound	A-A	5	0.70%
iv	paratactic-extending compound	A-A	56	7.82%
v	paratactic-enhancing compound	A-A	4	0.56%
	Sum		716	100%

It is obvious that the hypotactic-enhancing HNAC is far more productive than other categories. Paratactic-extending

and hypotactic-elaborating HAAC are relatively productive. We will illustrate each category with examples. The number going before the example is the ID for every instance of compound in the data. Every instance of compound in the data is assigned an ID for better organization, data management, easy retrieval, systematic tracking, version control, and research integrity.

(1) Hypotactic-elaborating compound (α =β)

In hypotactic-elaborating compound, the dependent constituent β is descriptive to the dominant constituent α. We take *rocky-hard* for example (**Table 9**).

The taxis and logico-semantic relation between the constituents of hypotactic-elaborating compound *rocky-hard* is illustrated in the following (**Table 10**).

Table 9. Representative Example of a Hypotactic-Elaborating Compound: *rocky-hard.*

ID	HAAC	Example
A10354	rocky-hard	1986 Small, dry, rocky-hard masses. [OED]

Table 10. Analysis of Taxis and Logico-Semantic Relation in *rocky-hard.*

Hypotactic-Elaborating Compound	***rocky-***	***hard***
taxis & logico-semantic relation	Modifier =β hypotactic-elaborating: clarification	Head α

Being not equal in status, 'rocky' modifies 'hard', clarifying it by indicating the kind of hardness is like that of a rock. The taxis and logico-semantic relation between the constituents can be specified as hypotactic-elaborating: clarification. Here ':' before 'clarification' is a symbol of operator in system specifications, representing 'entry condition leading to terms in system' [45]. Instances like *waxy-white, rosy-red, jetty-black, muddy-yellow, weedy-brown, peachy-pink, muddy-gray, mellow-deep, chilling-cold, icy-cold, stewing-hot, misty-soft, ruby-sweet, rotten-rich, goody-good, godly-wise* are all HAAC of this category.

(2) Hypotactic-enhancing compound (α ×β)

In hypotactic-enhancing compound, the dominant constituent α is modified by the dependent constituent β. For example, *ice-cold* (**Table 11**).

The taxis and logico-semantic relation between the constituents of hypotactic-enhancing compound *ice-cold* will be illustrated in the following (**Table 12**).

In this HNAC, 'ice' modifies 'cold' through embodying the kind of coldness resembling that of ice. The taxis and logico-semantic relation between the constituents can be specified as hypotactic-enhancing: manner: comparison. Other instances of hypotactic-enhancing HNAC are *gold-green, mouse-quiet, bee-loud, web-soft, rock-firm, buff-hard, powder-light, paper-thick.*

(3) Paratactic-elaborating compound (1 =2)

In paratactic-elaborating compound, the continuing constituent 2 restates or particularizes the initiating constituent 1, for example, *yellow-green* (**Table 13**).

The taxis and logico-semantic relation between the constituents of paratactic-elaborating compound *yellow-green* will be illustrated in the following (**Table 14**).

The semantic relation between 'yellow' and 'green' is apposition. Both constituents contribute to the creation of the sense of the compound, with each as an integrated part. This HAAC indicates a kind of intermediate color created by mixing a primary color with the secondary color next to it, that is, a mixture of yellow and green. Both constituents serve as semantic head, while 'yellow' particularizes the basis, the 'draft head' 'green' 'in encoding' [21,22]. The taxis and logico-semantic relation between the constituents can be specified as paratactic-elaborating: apposition. There are six intermediate color compound adjectives, of which five being treated as main entries in OED (including *red-orange, yellow-orange, yellow-green, blue-green,* and *blue-violet*). These five intermediate color compound adjectives plus *red-violet* all belong to compound of this category.

Table 11. Representative Example of a Hypotactic-Enhancing Compound: *ice-cold.*

ID	HNAC	Example
A10491	ice-cold	1887 The passionless heart of this ice-cold lover of mine. [OED]

Table 12. Analysis of Taxis and Logico-Semantic Relation in *ice-cold.*

Hypotactic-Enhancing Compound	***ice-***	***cold***
taxis & logico-semantic relation	Modifier ×β hypotactic-enhancing: manner: comparison	Head α

Table 13. Representative Example of a Paratactic-Elaborating Compound: *yellow-green.*

ID	HAAC	Example
A10294	yellow-green	a1887 The broad descending surfaces of yellow-green oak. [OED]

Table 14. Analysis of Taxis and Logico-Semantic Relation in *yellow-green.*

Paratactic-Elaborating Compound	***yellow-***	***green***
taxis & logico-semantic relation	semantic head =2 paratactic-elaborating: apposition	semantic head 1 Draft head

(4) Paratactic-extending compound (1 +2)

In paratactic-extending compound, the continuing constituent 2 extends the initiating constituent 1. For example, *sour-sweet* (**Table 15**).

The taxis and logico-semantic relation between the constituents of paratactic-extending compound *sour-sweet* will be illustrated in the following (**Table 16**).

Here 'sour' adds to 'sweet', making the sense of taste mixed but with more weight on the draft head. The HAAC means sweet with a mixture or aftertaste of sourness. The taxis and logico-semantic relation between the constituents can be specified as paratactic-extending: addition. Instances such as *purple-red, orange-red, red-black, deaf-mute, sweet-bright* are all of this category.

(5) Paratactic-enhancing compound (1 ×2)

In paratactic-enhancing compound, the continuing constituent 2 enhances the initiating constituent 1 with a circumstantial feature. We take *rich-rich* for example (**Table 17**).

The taxis and logico-semantic relation between the constituents of paratactic-enhancing compound *rich-rich* will be illustrated in the following (**Table 18**).

This category is also termed as reduplicative [13]. The left constituent enhances the right constituent in a way of multiplying the sense of 'rich', meaning 'extremely rich'. The taxis and logico-semantic relation between the constituents can be specified as paratactic-enhancing: manner: quality. Other HAAC instances of this category are *clever-clever, pretty-pretty, ling-long* ('ling' is the reduplication of 'long').

The first research question has been answered. The further classification of HNAC and HAAC is made based on the five categories of HNAC and HAAC.

Table 15. Representative Example of a Paratactic-Extending Compound: *sour-sweet.*

ID	HAAC	Example
A10705	sour-sweet	1871 He..peels carefully off the skin,..and eats the sour-sweet refreshing pulp. [OED]

Table 16. Analysis of Taxis and Logico-Semantic Relation in *sour-sweet.*

Paratactic-Extending Compound	***sour-***	***sweet***
taxis & logico-semantic relation	+2 paratactic-extending: addition	1 Draft head

Table 17. Representative Example of a Paratactic-Enhancing Compound: *rich-rich.*

ID	HAAC	Example
A10714	rich-rich	1977 Karl Lagerfeld always puts together a mouth-watering collection for Chloe (aiming towards those rich-rich women who buy from Valentino). [OED]

Table 18. Analysis of Taxis and Logico-Semantic Relation in *rich-rich.*

Paratactic-Enhancing Compound	***rich-***	***rich***
taxis & logico-semantic relation	Modifier ×2 paratactic-enhancing: manner: quality	Head 1

4.2. Internal Structural and Semantic Analysis of HNAC and HAAC

In the domain of logical metafunction from the SFL perspective, the analysis of the internal logical structure of HNAC and HAAC reveals that there are two general types of logical structure in HNAC and HAAC: (i) [Modifier ^ Head]; (ii) [Head ^ Draft Head]. While sharing common internal structural features, HNAC and HAAC also exhibit minor differences.

SFL treats experience as meaning which is construed in language. Language construes human experience as a semantic system. Semantically, HNAC and HAAC included in the data in current research all belong to simple quality of non-metaphorical category. There are two modes of meaning ideationally: the metaphorical mode of meaning and the non-metaphorical mode of meaning. The metaphorical mode of meaning does not apply to HNAC and HAAC in the current research.

The non-metaphorical modes of meaning of HNAC and HAAC can be described in the experiential and logical modes within the ideational-metafunctional modes of meaning. In the experiential mode, HNAC and HAAC are all simple qualities of non-metaphorical category, which can be represented as either quality[quality ^ quality] or quality[circumstance ^ quality]. The logical mode of meaning refers to the representation of inter-constituent relation in HNAC and HAAC by the system of taxis and logico-semantic relations. The analysis reveals that there are five types of semantic relation configurations in HNAC and HAAC: i) '=β/quality ^ α/quality'; ii) '×β/circumstance ^ α/quality'; iii) '=2/quality ^ 1/quality'; iv) '+2/quality ^ 1/quality'; v) '×2/circumstance ^ 1/quality'. The experiential mode and logical mode of meaning of HNAC and HAAC is shown in **Table 19**.

HNAC and HAAC examples are all from the data. More specific examples of taxis and logico-semantic relations in HNAC and HAAC are provided in Section 5.1.

Table 19. Experiential Mode and Logical Mode of Meaning of HNAC and HAAC.

Ideational-Metafunctional Mode of Meaning	Semantic Relation Configurations	HNAC and HAAC Examples
Experiential mode of meaning	quality [quality ^ quality]	*silky-soft, rocky-hard, oily-brown*
	quality [circumstance ^ quality]	*waist-deep, head-high, year-long*
Logical mode of meaning	'=β/quality ^ α/quality'	*silky-black, pearly-blue, rosy-red*
	'×β/circumstance ^ α/quality'	*ice-white, rose-red, forest-green*
	'=2/quality ^ 1/quality'	*blue-green, blue-violet, red-orange*
	'+2/quality ^ 1/quality'	*red-pink, white-grey, green-yellow*
	'×2/circumstance ^ 1/quality'	*clever-clever, rich-rich, pretty-pretty*

4.3. Common Patterns of HNAC and HAAC

The HNAC and HAAC in the current study are single premodifiers to the head noun in nominal groups. They are semantically simple qualities, while syntactically lexical words.

The HNAC and HAAC retrieved from the data have their unique morphological and semantic features. To address the second research question, through deep data analysis and mapping of the morphological and semantic features of HNAC and HAAC, common patterns of HNAC and HAAC in English are generalized based on the five prototypical types of taxis and logico-semantic relation within HNAC and HAAC.

With the prototypical type of hypotactic-elaborating compound, there is one subtype of clarification. With the prototypical type of hypotactic-enhancing compound, there are six subtypes covering six circumstantial elements of time, place, manner, cause, condition, and matter. And further classifications can be made in first five subtypes.

With the prototypical type of paratactic-elaborating compound, there is one subtype of apposition. With the prototypical type of paratactic-extending compound, there are two subtypes: addition and variation. With the prototypical type of paratactic-enhancing compound, there is one subtype of manner: quality.

Altogether fourteen common patterns of HNAC and HAAC in English can be identified based on fourteen features of expansion between constituents of HNAC and HAAC: (i) Hypotactic-elaborating: clarification; (ii) Hypotactic-enhancing: spatio-temporal: place: point(s); (iii) Hypotactic-enhancing: spatio-temporal: place: extent; (iv) Hypotactic-enhancing: spatio-temporal: time: extent; (v) Hypotactic-enhancing: manner: comparison; (vi) Hypotactic-enhancing: manner: degree; (vii) Hypotactic-enhancing: causal-conditional: cause: reason; (viii) Hypotactic-enhancing: causal-conditional: cause: purpose; (ix) Hypotactic-enhancing: causal-conditional: condition: positive; (x) Hypotactic-enhancing: matter: respective; (xi) Paratactic-elaborating: apposition; (xii) Paratactic-extending: addition; (xiii) Paratactic-extending: variation; xiv) Paratactic-enhancing: manner: quality. They are shown with evidence of instances from the data in **Table 20**.

The productivity of fourteen common patterns of HNAC and HAAC in the data is given in **Table 21**.

The evidence of instances of each common pattern shows that, the hypotactic-enhancing: manner: comparison HNAC is the most prominent pattern of all, accounting for 52.79% of all HNAC and HAAC in the data; the hypotactic-enhancing: place: point(s) HNAC, the hypotactic-enhancing: matter: respective HNAC, and the hypotactic-elaborating: clarification HAAC are the second most prominent patterns, together accounting for 24.44%; the hypotactic-enhancing: place: extent HNAC, the hypotactic-enhancing: manner: degree HNAC, the hypotactic-enhancing: condition: positive HNAC are relatively outstanding, altogether taking up 9.49%; the paratactic-extending: addition HAAC accounts for 6.15%, showing its relative popularity among the fourteen patterns.

Table 20. Features of Hypotactic and Paratactic Expansion in HNAC and HAAC (Adapted from Halliday and Matthiessen [45]).

Expansion			Hypotactic	Paratactic
Category	Subtype		Instances	Instances
elaboration	apposition		-	√
	clarification		√	-
extension	addition		-	√
	variation		-	√
enhancement	spatio-temporal: place	extent	√	-
		point(s)	√	-
	spatio-temporal: time	extent	√	-
		point(s)	-	-
	manner	means	-	-
		quality	-	√
		comparison	√	-
		degree	√	-
	causal-conditional: cause	reason	√	-
		result	-	-
		purpose	√	-
		insurance	-	-
	causal-conditional: condition	positive	√	-
		negative	-	-
		concessive	-	-
	matter	respective	√	-

Note. The symbol '√' means presence of instances; '-' means absence of instances in the data.

Table 21. Productivity of Fourteen Patterns of HNAC and HAAC.

N	Category Notation	Subtype	Instances	Percentage
1	'=β ^ α'	clarification	61	8.52%
2		place: point(s)	63	8.80%
3		place: extent	32	4.47%
4		time: extent	12	1.68%
5		manner: comparison	378	52.79%
6	'×β ^ α'	manner: degree	20	2.79%
7		cause: reason	7	0.98%
8		cause: purpose	11	1.54%
9		condition: positive	16	2.23%
10		matter: respective	51	7.12%
11	'=2 ^ 1'	apposition	5	0.70%
12	'+2 ^ 1'	addition	44	6.15%
13		variation	12	1.68%
14	'×2 ^ 1'	manner: quality	4	0.56%
	Sum		716	100%

5. Discussion

5.1. Generalizing the Internal Semantic Relations Between the Constituents of HNAC and HAAC

Based on the analysis of all 716 HNAC and HAAC, we can generalize the internal semantic relations between the constituents of HNAC and HAAC as shown in **Table 22**.

Instances of each pattern of HNAC and HAAC are interpreted in the following to shed light on the morphological and semantic features of HNAC and HAAC. All quotation texts are from the online OED, serving as the contexts of occurrence.

5.1.1. Hypotactic-Elaborating: Clarification

In the HAAC pattern of Hypotactic-Elaborating: Clarification Subtype, A_2 clarifies A_1 in various ways. The logical structure of A_2-A_1 is 'SubModifier ^ SubHead', and

the logical mode of meaning of A_2-A_1 is '=β/quality ^ α/quality'. For example, '*wan-white*' and '*drear-white*' are both of white color, with different connotations impressed by the meaning of each of the elaborating constituent. Other HAAC instances among the 61 instances of this subtype in the dataset are *dim-grey, milky-white, orangey-red, jetty-black, orangey-yellow, whitey-brown, peachy-pink, pearly-gray*.

In the HNAC patterns of Hypotactic-enhancing category, the logical structure of N-A is 'SubModifier ^ SubHead', and the logical mode of meaning of N-A is '×β/circumstance ^ α/quality'. N modifies A, contributing a circumstantial element such as time, place, manner, cause, condition, and matter.

5.1.2. Hypotactic-Enhancing: Spatio-Temporal: Place: Point(s)

In the HNAC pattern of Hypotactic-Enhancing: Spatio-Temporal: Place: Point(s) Subtype, the relation is 'A as to reach N' or 'A as N'. N modifies A by assigning the sense of point(s) on a spatial scale being approached. For example, '*ankle-deep*' in 'the *ankle-deep* snow' and '*breast-deep*' in 'the *breast-deep* snow' particularize that the snow comes to reach to the point of ankle/breast, or to cover the ankle/chest. Other HAAC instances among the 63 instances of this subtype in the dataset are *bosom-deep, girth-deep, nave-deep, chest-deep, sea-deep, crotch-deep, yard-deep, heaven-high, nose-high, tower-high, marble-tall, man-tall.*

5.1.3. Hypotactic-Enhancing: Spatio-Temporal: Place: Extent

In the HNAC pattern of Hypotactic-Enhancing: Spatio-Temporal: Place: Extent Subtype, the relation is 'A extending throughout N' or 'as A as (a/an) N'. N modifies A by assigning the sense of extent on a spatial scale being approached. For example, '*league-long*' in 'the *league-long* rampart-fire', and '*ell-wide*' in 'that *ell-wide* muslin' specify that the fire/muslin extends the length/width of a league/ell. *League* is a former measure of distance by land, usually about three miles, and *ell* is a former measure of length (equivalent to six hand breadths) used mainly for textiles, typically about 45 inches. Other HAAC instances among the 32 instances of this subtype in the dataset are *block-long, desert-long, thigh-long, gap-wide, basin-wide, sea-wide, yard-wide, wing-wide, mile-wide, league-wide, country-wide, ocean-wide, race-wide, toe-wide, province-wide, area-wide.*

5.1.4. Hypotactic-Enhancing: Spatio-Temporal: Time: Extent

In the HNAC pattern of Hypotactic-Enhancing: Spatio-Temporal: Time: Extent Subtype, the relation is 'A spanning throughout N' or 'as A as (a/an) N'. N modifies A by assigning the sense of extent on a temporal scale being approached. For example, '*years-long*' in '*years-long* consumption' indicate that the consumption lasts for years. '*Week-long*' in '*week-long* fastings' specifies that the fastings have lasted for one week. '*Age-long*' in 'an *age-long* cultural tradition' specifies that the cultural tradition has lasted for an age. Other HAAC instances among the 12 instances of this subtype in the dataset are *summer-long, span-long, hour-long, year-long, month-long, century-long, tone-long, noon-wide, winter-old*.

5.1.5. Hypotactic-Enhancing: Manner: Comparison

In the HNAC pattern of Hypotactic-Enhancing: Manner: Comparison Subtype, the relation is 'as A as N'. N modifies A by assigning the sense of extent or degree by comparison where a physical object is used as a measure. For example, '*gold-yellow*' in 'a *gold-yellow* hue' indicates kinds of yellow resembling or reminiscent of the colors of gold. '*Rain-loud*' in 'the *rain-loud* silence' describes that it is not perfect silence but with steady drone of noise resembling the rhythm of rain. Other HAAC instances among the 378 instances of this subtype in the dataset are *gold-red, gold-green, gold-brown, silver-black, umber-black, umber-brown, azure-blue, milk-white, moon-yellow, pumpkin-orange, nut-brown, sun-hot, blood-warm, stone-hard, neck-stiff.*

5.1.6. Hypotactic-Enhancing: Manner: Degree

In the HNAC pattern of Hypotactic-Enhancing: Manner: Degree Subtype, the relation is 'very/extremely/exceedingly A' or 'as A as N'. N modifies A by assigning the sense of great degree or very high standard. For example, '*world-old*' and '*age-old*' in 'the *world-old* question' 'the *age-old* problem' are synonymous, meaning 'extremely old'. Both put emphasis on the complexity or extremity and maybe seriousness of the problem. It implies that the issue has been around for so long that it's a fundamental or deeply-rooted aspect of human existence or an enduring challenge. Other HAAC instances among the 20 instances of this subtype in the dataset are *rat-poor, mouse-poor, dirt-poor, piss-poor, dirt-cheap, whip-smart, world-rich, world-deep, world-high, world-long, crystal-clear, sun-clear, butt-ugly, fathom-deep, stone-dumb*.

5.1.7. Hypotactic-Enhancing: Causal-Conditional: Cause: Reason

In the HNAC pattern of Hypotactic-Enhancing: Causal-Conditional: Cause: Reason Subtype, the relation is 'A because of N'. N modifies A by assigning the sense of reason. For example, 'the *land-poor* farmer' means that the farmer's poorness was due to the burden of land. '*Oil-rich* Arab' refers to Arab being rich because of oil. Other HAAC instances among the seven instances of this subtype in the dataset are *time-white, penny-white, work-hard, age-cold, wonder-dumb*.

5.1.8. Hypotactic-Enhancing: Causal-Conditional: Cause: Purpose

In the HNAC pattern of Hypotactic-Enhancing: Causal-Conditional: Cause: Purpose Subtype, the relation is 'A to withstand N' or 'A to/for N'. N modifies A by assigning the sense of purpose. For example, 'the *foot-firm* sand' refers to the sand which is firm to the feet. 'My *money-mad* fellow-men' indicates that my fellow-men are obsessed with making money. 'An *eye-safe* laser' refers to the laser which is designed to operate without causing damage to human eyes. Other HAAC instances among the 11 instances of this subtype in the dataset are *foot-firm, wind-hard, bull-strong, eye-sweet, heart-smart, tiptoe-nice, nose-wise*.

5.1.9. Hypotactic-Enhancing: Causal-Conditional: Condition: Positive

In the HNAC pattern of Hypotactic-Enhancing: Causal-Conditional: Condition: Positive Subtype, the relation is 'A in case of N'. N modifies A by assigning the sense of condition. For example, '*book-smart*' meaning 'bookish' or 'having knowledge acquired from books or study'. '*Street-smart*' means 'having the skills and knowledge necessary for dealing with modern urban life'. 'A *vote-wise* politician' specifies that the politician knows well about how to win votes in an election. Other HAAC instances among the 16 instances of this subtype in the dataset are *world-wise, weather-wise, way-wise, moon-wise, sea-wise, web-wise, pound-foolish, penny-wise, colour-weak, canon-wise, head-wrong*.

5.1.10. Hypotactic-Enhancing: Matter: Respective

In the HNAC pattern of Hypotactic-Enhancing: Matter: Respective Subtype, the relation is 'A in respect of N'. N modifies A, meaning 'in respect of'. For example, '*sound-sweet* Medicines' indicate the medicines which are sweet in the respect of sound. '*Will-strong* Objector' refers to the objector being strong in the respect of will. Other HAAC instances among the 51 instances of this subtype in the dataset are *hammer-strong, shaft-strong, tongue-dumb, head-wise, lip-wise, iron-rich, vote-rich, uranium-rich, neutron-rich, information-rich, species-rich, target-rich, swan-poor*.

5.1.11. Paratactic-Elaborating: Apposition

In the HAAC pattern of Paratactic-Elaborating: Apposition Subtype, the logical structure of A_2-A_1 is 'Head ^ Draft Head', and the logical mode of meaning of A_2-A_1 is '=2/quality ^ 1/quality'. The relation is 'A_2 and A_1 simultaneously in one'. A_2 particularizes the basis A_1, also the draft head in encoding [21,22], with a sense of simultaneity. For color compounds of this pattern, they refer to the kind of color created by mixing a primary color with the secondary color next to it with equal weight, including *red-orange*, *yellow-orange*, *yellow-green*, *blue-green*, *red-violet* (not treated as a main entry in OED) and *blue-violet*.

5.1.12. Paratactic-Extending: Addition

In the HAAC pattern of Paratactic-extending category, the logical structure of A_2-A_1 is 'Head ^ Draft Head', and the logical mode of meaning of A_2-A_1 is '+2/quality ^ 1/quality'. In the HAAC pattern of Paratactic-Extending: Addition Subtype, the relation is 'both A_2 and A_1 in one'. A_2 extends A_1 with a mixture reading [36]. The mixture of two with more weight on the draft head A_1 indicates that the sense of the draft head dominates while supplemented with a new element approaching the sense of the non-head constituent A_2. '*Orange-red* berries' are berries with a shade of red approaching orange. 'A *purple-black* seed' is a seed with a shade of black approaching purple. Other HAAC instances among the 44 instances of this subtype in the dataset are *green-black, brown-black, purple-blue, grey-blue, green-blue, blue-purple, red-purple, white-yellow, red-yellow, green-yellow, orange-yellow, yellow-brown, white-brown, purple-brown, orange-brown, purple-pink, orange-pink, red-pink*.

5.1.13. Paratactic-Extending: Variation

In the HAAC pattern of Paratactic-Extending: Variation Subtype, the relation is 'A_1 with A_2 highlights', or 'A_1 or A_2', or 'A_1 and A_2 in succession'. A_2 extends A_1 with a simultaneous interpretation [36]. '*Red-white* blossoms', '*white-red* flowers', '*white-green* lacinated leaves' indicate plant parts with the natural combination of two colors with one alongside the other. The two can be of similar or different weight. Other HAAC instances among the 12 instances of this subtype in the dataset are *yellow-white, blue-white, yellow-red, white-blue, purple-green, brown-green, yellow-brown, white-brown, right-wrong, true-false*.

5.1.14. Paratactic-Enhancing: Manner: Quality

In the HAAC pattern of Paratactic-Enhancing: Manner: Quality Subtype, the logical structure of A_2-A_1 is 'SubModifier ^ SubHead', and the logical mode of meaning of A_2-A_1 is '×2/circumstance ^ 1/quality'. The relation is 'A_1 in (a/an) A_2 manner/way' or 'A_1 and A_2 in superposition'. A_2 modifies A_1 by making emphasis through superposition or reduplication, expressing greatness in the scale or degree. '*Pretty-pretty* sentimentalists' means very pretty sentimentalists. '*Busy-busy* lifestyle' refers to very or excessively busy lifestyle. *Clever-clever*, *ling-long* are two more instances of this subtype.

Through the description of the internal semantic relation within HNAC and HAAC, it can be seen that the fourteen common patterns of HNAC and HAAC based on fourteen features of expansion between constituents of HNAC and HAAC in English are consistent with the five categories of HNAC and HAAC. The consistency in the categorization of HNAC and HAAC validates the model of

taxis and logico-semantic types of HNAC and HAAC. Together with corpus-assisted discourse analysis, the generalizations of fourteen common patterns of HNAC and HAAC demonstrate that the theories of ideational metafunction and the taxis and logico-semantic relation of expansion from SFL provide a valuable framework which enhances the understanding of the meaning and the sense-relation between the constituents of HNAC and HAAC.

Table 22. Sense-Relation Patterns of HNAC and HAAC.

N	Category	Subtype	Form	Relation	Instances
1	hypotactic-elaborating	clarification	A_2-A_1	'A_1 clarified by A_2'	wan-white, drear-white
2	hypotactic-enhancing	place: point(s)	N-A	'A as to reach N'; 'A as N'	ankle-deep, breast-deep
3		place: extent	N-A	'A extending throughout N'; 'as A as (a/an) N'	league-long, ell-wide
4		time: extent	N-A	'A spanning throughout N'; 'as A as (a/an) N'	week-long, years-long
5		manner: comparison	N-A	'as A as N'	gold-yellow, rain-loud
6		manner: degree	N-A	'very/extremely/exceedingly A'; 'as A as N'	world-old, age-old
7		cause: reason	N-A	'A because of N'	land-poor, oil-rich(2)
8		cause: purpose	N-A	'A to withstand N'; 'A to/for N'	foot-firm, money-mad
9		condition: positive	N-A	'A in case of N'	book-smart, vote-wise
10		matter: respective	N-A	'A in respect of N'	sound-sweet, will-strong
11	paratactic-elaborating	apposition	A_2-A_1	'A_2 and A_1 simultaneously in one'	yellow-orange, blue-green
12	paratactic-extending	addition	A_2-A_1	'both A_2 and A_1 in one'	orange-red, purple-black
13		variation	A_2-A_1	'A_1 with A_2 highlights'; 'A_1 or A_2', 'A_1 and A_2 in succession'	red-white, white-green
14	paratactic-enhancing	manner: quality	A_2-A_1	'A_1 in (a/an) A_2 manner/way'; 'A_1 and A_2 in superposition'	pretty-pretty, busy-busy

5.2. Comparing The Categorization with Multiple Theoretical Models

5.2.1. Comparison with Bauer and Huddleston's Sense-Relation Patterns

Our categorization of compounds and generalizations of the internal semantic relations between the constituents of HNAC and HAAC provide 10 more patterns than the five sense-relation patterns of N-A and A-A Compounds generalized by Bauer and Huddleston [14], as shown in **Table 1**. And five of fourteen patterns coincide or overlap with each other.

(1) Subtype 1 'Hypotactic-elaborating: clarification' coincides with Pattern 5 Subordinative: 'A_2 modifies A_1';

(2) Subtype 2 'Hypotactic-enhancing: place: point(s)' coincides with Pattern 2 Measure terms: 'A to the extent of N';

(3) Subtype 5 'Hypotactic-enhancing: manner: comparison' coincides with Pattern 1 Comparative/Intensifying: 'A as N';

(4) Subtype 10 'Hypotactic-enhancing: matter: respective' overlaps with Pattern 3 Incorporated complement/modifier: 'N complements/modifies A';

(5) Subtype 12 'Paratactic-extending: addition' coincides with Pattern 4 Coordinative: 'A_2 and A_1';

5.2.2. Comparison with Conti's Major Types of N-A and A-A Compound Adjectives

There are a few more similarities between our classification and the classification in Conti [16], as shown in **Table 2**.

(6) Subtypes 2, 3, 4 overlap with Type 2 Subordinative: Time & Space compounds;

(7) Subtype 9 'Hypotactic-enhancing: condition: positive' coincides with Type 3 Subordinative: Restrictive/specifying compounds;

(8) Subtype 11 'Paratactic-elaborating: apposition' coincides with Type 5 Copulative: Appositional compounds;

(9) Subtype 12 'Paratactic-extending: addition' and 13 'Paratactic-extending: variation' overlap with Type 6 Copulative: Coordinative (and Complementary) compounds;

5.2.3. Comparison with Jackendoff's Basic Functions in Schemas of NN Compound

By comparison, we can find that our generalizations of the internal semantic relations between the constituents of

HNAC and HAAC provide one more sense-relation than the basic relations in the Schemas of NN Compound by Jackendoff [35], as shown in **Table 3**. After close examination of the two frameworks, we find that, between the semantic relations within hyphenated N-A compounds and A-A compounds and the semantic relations within NN compounds, there are overlapping or coincidences at five points.

(10) Subtype 1 'Hypotactic-elaborating: clarification' coincides with Function 1 CLASSIFY (X_1, Y_2): 'N_1 classifies N_2';

(11) Subtype 2 'Hypotactic-enhancing: place: point(s)' and subtype 3 'Hypotactic-enhancing: place: extent' coincide with Function 7 LOC (X_1,Y_2): 'N_2 is located at/in/on N_1';

(12) Subtype 4 'Hypotactic-enhancing: time: extent' coincides with Function 8 LOC_{temp} (X_1, Y_2): 'N_2 takes place at time N_1';

(13) Subtype 5 'Hypotactic-enhancing: manner: comparison' overlaps with Function 4 SAME/SIMILAR (X_1, Y_2): 'N_1 and N_2 are the same/similar';

(14) Subtype 7 'Hypotactic-enhancing: cause: reason' coincides with Function 9 CAUSE (X_1, Y_2): 'N_2 caused by N_1'.

To summarize, these comparisons indicate that the three mentioned theories and the SFL theories of ideational metafunction and model of the taxis and logico-semantic relation of expansion reach the similar goal of decoding the internal semantic relationships between the constituents in NN compounds and that in HNAC and HAAC through separate routes. The SFL theories of ideational metafunction and taxis and logico-semantic relation for word complexing offer an important alternative in explaining the semantics of HNAC and HAAC and revealing the morphological and semantic features of HNAC and HAAC in a systematic approach.

6. Conclusion

6.1. Findings

With the theories of ideational metafunction and the taxis and logico-semantic relation of expansion from SFL, the study employs corpus-assisted discourse analysis in categorizing HNAC and HAAC in English and carrying out the description of the morphological and semantic features of HNAC and HAAC. It makes categorization of HNAC and HAAC into five prototypical types: hypotactic-elaborating compound, hypotactic-enhancing compound, paratactic-elaborating compound, paratactic-extending compound, and paratactic-enhancing compound. Subsequently, fourteen common patterns of internal semantic relations in HNAC and HAAC have been formulated. The study reveals that the SFL theoretical model of taxis and logico-semantic types of word complexing is efficiently supportive of our description and analysis in categorizing HNAC and HAAC and generalizing the internal semantic relations in HNAC and HAAC.

6.2. Limitations

There are two limitations in this study. First is the data size. The size of the English HNAC and HAAC data set is still relatively small. In order to fully capture the semantic features of HNAC and HAAC, it is better to include more data for the generalization of common patterns and for the supporting of the theoretical model. In mitigation, the study managed to cover data with a wider range of adjectival heads and exhaust all appropriate compounds composed with one adjectival heads. The second limitation is that the generalization of common patterns might not be complete, and a few other patterns might come up with certain amount of data. The theoretical model of taxis and logico-semantic types of HNAC and HAAC is the basis of subcategorization. Any possible patterns can only make the revelation of the semantics of HNAC and HAAC thorough and make the theory more applicable.

6.3. Implications for Future Studies

This research can serve as a meaningful resource to English users for their understanding of the unique morphological and semantic features of HNAC and HAAC. The future work should advance the knowledge of HNAC and HAAC with more systemic examination of HNAC and HAAC facilitated by larger corpus and more detailed description in terms of delicacy.

Author Contributions

Conceptualization, J.W.; methodology, Y.A. and H.L.; validation, J.W.; formal analysis, J.W.; investigation, J.W.; resources, J.W.; data curation, J.W.; writing—original draft preparation, J.W.; writing—review and editing, J.W.; supervision, Y.A. and H.L. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

References

[1] Sun, K., Baayen, R.H., 2021. Hyphenation as a compounding technique in English. Language Sciences. 83, 101326. DOI: https://doi.org/10.1016/j.langsci.2020.101326

[2] Oxford University Press, n.d. Rich, adj, 3.b. Oxford English Dictionary. DOI: https://doi.org/10.1093/OED/1022196627

[3] Oxford University Press, n.d. Rich, adj., 2.a.i. Oxford English Dictionary. DOI: https://doi.org/10.1093/OED/3357387048

[4] Bloomfield, L., 1933. Language. Holt: New York, NY, USA.

[5] Jespersen, O., 1942. A Modern English Grammar on Historical Principles, vol. 6 Morphology. Ejnar Munksgaard: Copenhagen, Denmark.

[6] Marchand, H., 1955. Notes on nominal compounds in present-day English. Word. 11(2), 216–227. DOI: https://doi.org/10.1080/00437956.1955.11659558

[7] Marchand, H., 1969. The Categories and Types of Present-Day English Word-Formation: A Synchronic-Diachronic Approach, 2nd rev. ed. C. H. Beck'sche Verlagsbuchhandlung: Munich, Germany. p. 11.

[8] Harris, Z.S., 1963. Structural Linguistics. The University of Chicago Press: Chicago, IL, USA.

[9] Adams, V., 1973. An Introduction to Modern English Word-Formation. Longman: London, UK.

[10] Bauer, L., 1983. English Word-Formation. Cambridge University Press: Cambridge, UK.

[11] Bauer, L., 2003. Introducing Linguistic Morphology, 2nd ed. Georgetown University Press: Washington, DC, USA.

[12] Fabb, N., 1998. Compounding. In: Spencer, A., Zwicky, A.M. (eds.). Handbook of Morphology. Blackwell: Oxford, UK. pp. 66–83.

[13] Biber, D., Johansson, S., Leech, G., et al., 2000. Longman Grammar of Spoken and Written English. Foreign Language Teaching and Research Press: Beijing, China.

[14] Bauer, L., Huddleston, R., 2002. Lexical word-formation. In: Huddleston, R., Pullum, G.K. (eds.). The Cambridge Grammar of the English Language. Cambridge University Press: Cambridge, UK. pp. 1656–1658.

[15] Pultrová, L., 2019. The category of comparison and compound adjectives in Latin. Eirene. Studia Graeca et Latina. 55, 67–116.

[16] Conti, S., 2007. Compound Adjectives in English: A Descriptive Approach to Their Morphology and Functions [Doctoral Dissertation]. Università di Pisa: Pisa, Italy. pp. 1–259.

[17] Lieber, R., Štekauer, P., 2009. Introduction: Status and definition of compounding. In: Lieber, R., Štekauer, P. (eds.). The Oxford Handbook of Compounding. Oxford University Press: Oxford, UK. pp. 13, 15.

[18] Bauer, L., Lieber, R., Plag, I., 2013. The Oxford Reference Guide to English Morphology. Oxford University Press: Oxford, UK.

[19] Zhang, X., Lv, A., Dai, W., 2017. A Study of English Compound Words [Yingyu fuheci yanjiu]. World Publishing House: Beijing, China.

[20] Williams, E., 1981. On the notions "Lexically related" and "Head of a Word". Linguistic Inquiry. 12(2), 245–274.

[21] Rong, X., 2012. On duplocephy [Yici shuangxin]. Translations [Yilin]. 2012(2), 152–163.

[22] Rong, X., 2012. Appositional Compounding with Internal Semantic Features [Yuyi fuhe zhong de neibu tezheng tongwei]. Peking University Press: Beijing, China. pp. 10, 102–103.

[23] Francis, W.N., 1958. The Structure of American English. The Ronald Press Company: New York, NY, USA.

[24] Hockett, C.F., 1958. A Course in Modern Linguistics. Macmillan: New York, NY, USA.

[25] Gleason, H.A., 1955. An Introduction to Descriptive Linguistics, rev. ed. Holt, Rinehart and Winston: New York, NY, USA.

[26] Bolinger, D.L., Gerstman, L.J., 1957. Disjuncture as a cue to constructs. Word. 13(2), 246–255. DOI: https://doi.org/10.1080/00437956.1957.11659636

[27] Roeper, T., Siegel, M.E., 1978. A lexical transformation for verbal compounds. Linguistic Inquiry. 9(2), 199–260.

[28] Selkirk, E.O., 1981. English compounding and the theory of word-structure. In: Moortgat, M., Hulst, H.v.d., Hoekstra, T. (eds.). The Scope of Lexical Rules. DOI: https://doi.org/10.1515/9783112327364-008

[29] Lieber, R., 1983. Argument linking and compounds in English. Linguistic Inquiry. 14(2), 251–285.

[30] Lieber, R., 2005. English word-formation processes. In: Štekauer, P., Lieber, R. (eds.). Handbook of Word-Formation. Springer: Dordrecht, The Netherlands.

[31] Baker, M., 1985. The mirror principle and morphosyntactic explanation. Linguistic Inquiry. 16(3), 373–415.

[32] Guevara, E., Scalise, S., 2009. Searching for universals in compounding. In: Scalise, S., Magni, E., Bisetto, A. (eds.). Universals of Language Today: Studies in Natural Language and Linguistic Theory. Springer: Dordrecht, The Netherlands.

[33] Scalise, S., Bisetto, A., 2009. The classification of compounds. In: Lieber, R., Štekauer, P. (eds.). The Oxford Handbook of Compounding. Oxford University Press: Oxford, UK.

[34] Lieber, R., 2009. A lexical semantic approach to compounding. In: Lieber, R., Štekauer, P. (eds.). The Oxford Handbook of Compounding. Oxford University Press: Oxford, UK.

[35] Jackendoff, R.S., 2009. Compounding in the Parallel Architecture and Conceptual Semantics. In: Lieber, R., Štekauer, P. (eds.). The Oxford Handbook of Compounding. Oxford University Press: Oxford, UK.

[36] Lieber, R., 2009. IE, Germanic: English. In: Lieber, R., Štekauer, P. (eds.). The Oxford Handbook of Compounding. Oxford University Press: Oxford, UK.

[37] Meys, W.J., 1975. Compound Adjectives in English and the Ideal Speaker-Listener: A Study of Compounding in a Transformational-Generative Framework. North-Holland: Amsterdam, The Netherlands.

[38] Levi, J.N., 1978. The Syntax and Semantics of Complex Nominals. Academic Press: New York, NY, USA.

[39] Lieber, R., 1980. On the Organization of the Lexicon [Doctoral Dissertation]. Massachusetts Institute of Technology: Cambridge, MA, USA.

[40] DiSciullo, A.M., Williams, E., 1987. On the Definition of Word. MIT Press: Cambridge, MA, USA.

[41] Lieber, R., 2006. Syntax of words. In: Brown, K. (ed.). The Encyclopedia of Language and Linguistics, 2nd ed. Elsevier: Oxford, UK. DOI: https://doi.org/10.1016/B0-08-044854-2/00144-9

[42] Jackendoff, R.S., 1997. The Architecture of the Language Faculty. MIT Press: Cambridge, MA, USA.

[43] Jackendoff, R.S., 2002. Foundations of Language. Oxford University Press: Oxford, UK.

[44] Halliday, M.A.K., Matthiessen, C.M.I.M., 1999. Construing Experience Through Meaning: A Language-Based Approach to Cognition. Continuum: London, UK.

[45] Halliday, M.A.K., Matthiessen, C.M.I.M., 2014. Halliday's Introduction to Functional Grammar, 4th ed. Routledge: London, UK.

[46] Jackendoff, R.S., 2016. English noun-noun compounds in Conceptual Semantics. In: ten Hacken, P. (ed.). The Semantics of Compounding. Cambridge University Press: Cambridge, UK. pp. 15–37.

[47] Andersen, T.H., Holsting, A.E.M., 2018. Clause complexing in systemic functional linguistics – towards an alternative description. Functional Linguistics. 5(1), 1–25. DOI: https://doi.org/10.1186/s40554-018-0059-7

[48] Quirk, R., Greenbaum, S., Leech, G., et al., 1985. A Comprehensive Grammar of the English Language. Longman: London, UK.

[49] Huddleston, R., Pullum, G.K., 2002. The Cambridge Grammar of the English Language. Cambridge University Press: Cambridge, UK.

[50] Halliday, M.A.K., 1985. An Introduction to Functional Grammar, 1st ed. Edward Arnold: London, UK.

[51] Halliday, M.A.K., 1994. An Introduction to Functional Grammar, 2nd ed. Edward Arnold: London, UK.

[52] Halliday, M.A.K., Matthiessen, C.M.I.M., 2004. An Introduction to Functional Grammar, 3rd ed. Routledge: London, UK.

[53] Oxford University Press, n.d. Compounds and headwords. Oxford English Dictionary. Available from: https://www.oed.com/information/understanding-entries/compounds-and-headwords/ (cited 12 June 2024).