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A MISMATCH BETWEEN GRAMMATICAL AND PHONOLOGICAL STRUCTURES OF COMPOUND NOUNS IN ENGLISH AND JAPANESE*

1 INTRODUCTION

This article is concerned with a mismatch between grammatical and phonological structures of compound nouns in English and Japanese within the framework of Construction Grammar (Fillmore, Kay and O'Connor 1988 and Goldberg 1995) and Cognitive Grammar (Langacker 1987, 1991, 1999). Although there is some difference between them, they agree in that linguistic knowledge consists of numerous constructions. We adopt a constructional view of grammar in the sense of Langacker (2003), and take a nonreductionist approach to grammar (Bybee 2001, Kumashiro 2003, Välimaa-Blum 2005). Although our analysis challenges mainstream phonological approaches to compound nouns in English and Japanese, we shall show that our proposed method accounts for the facts that are left unexplained in the previous studies. English and Japanese compound nouns are illustrated by sentences such as the following:¹

- (1) a. [[parent-TEACHER] association]
 b. [[Tom PAINE] Street]
 c. [[Second LANGUAGE] Conference]

(Kubozono 1995: 135)

- (2) a. [[jjiyu minshu] too]
 freedom democracy party
 ‘Liberal-Democratic Party’
 a.’ || jjiyu’u || minshu to’o ||
 b. [[marukusu reenin] shugi]

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¹ We follow Kubozono’s (1993, 1995) notation. The stress is expressed in bold characters. The apostrophe (’) stands for the nuclear accent and the double bar (||) indicates a phonological boundary.

- Marx Lenin principle
 ‘Marxism-Leninism’
 b.’ || ma’rukusu || reenin shu’gi ||
 (3)a. [[[jiyu minshu] too] taikai]
 freedom democracy party conference
 ‘Liberal-Democratic Party Conference’
 a.’ || jiyu’u || minshu too tai’kai ||
 b. [[[marukusu reenin] shugi] shisoo]
 Marx Lenin principle idea
 ‘the idea of Marxism-Leninism’
 b.’ || ma’rukusu || reenin shugi shi’soo ||

(Kubozono 1995: 127–128)

Although in terms of a compound stress pattern in English the examples in (1) should have their main stress on the first elements *parent*, *Tom*, and *second*, in fact, they have on the second elements *teacher*, *Paine*, and *conference*, respectively. In contrast to English compounds, in Japanese ones, the first element *jiyuu* ‘freedom’ grammatically forms a unified unit with the second element *minshu* ‘democracy’ in (2a), whereas the latter phonologically forms a unit with the third element *too* ‘party.’ Likewise, in (2b) the first element *marukusu* ‘Marx’ grammatically forms a unified unit with the second element *reenin* ‘Lenin,’ while the latter phonologically forms a unit with the third element *shugi* ‘principle.’ The same holds for the examples (3a, b), which consist of four elements. The first elements grammatically form a unified unit with the second elements, whereas the three elements *minshu* ‘democracy,’ *too* ‘party,’ and *taikai* ‘conference’ in (3a) and *reenin* ‘Lenin,’ *shugi* ‘principle,’ and *shisoo* ‘idea’ in (3b) phonologically form a unit, respectively. In this paper, we argue that English compound nouns are captured by focusing upon the final and the penultimate element, and Japanese ones are captured in terms of “category overlap.” The notion of category overlap in this paper refers to the fact that Japanese compound nouns have a commonality between the pattern of initial bare noun phrases (BNPs) and the pattern in which the categorically same forms are repeated.

The structure of this article is as follows. In section 2, we will consider how previous analyses deal with the mismatch phenomenon between grammatical structure and phonological structure of English and Japanese compounds. Section 3 introduces theoretical assumptions in this paper. In section 4, we provide a usage-based analysis for English and Japanese compound nouns. The final section, section 5, presents concluding remarks.

2 PREVIOUS ANALYSES

In this section, we shall give an overview of the previous analyses of compound nouns in English and Japanese.

2.1 English Compound Nouns

Although Chomsky and Halle (1968: 372) consider a mismatch between grammatical structure and phonological structure as a part of performance, it has been claimed that it should be treated as a competence phenomenon by some linguists, for example, Selkirk (1984) and Nespor and Vogel (1986). Concerning the mismatch phenomenon of compound nouns, we cannot state that there has been enough discussion on it, as seen in ad hoc “readjustment rules.” Before considering it, let us first look at the compound stress pattern in English:

- (4) a. BLACK board
- b. black BOARD

In English, a compound stress takes the configuration [Strong Weak], as seen in (4a), whereas a phrasal stress takes [Weak Strong] as in (4b) (Bolinger 1989).²

Turning to the compounds which consist of three elements, as pointed out by the literature, there are two types of compound, i.e. compounds involving the left-branching structure and the ones involving the right-branching structure, as in (5):

- (5) a. [[COMPUTER class] instructor]
- b. [[COMMUNITY center] building]
- c. [[LIGHThouse] keeper]

(Kubozono 1995: 90)

- (6) a. [evening [COMPUTER class]]
- b. [theater [TICKET office]]
- c. [kitchen [TOWEL rack]]
- d. [supermarket [DELIVERY service]]
- e. [chemistry [RESEARCH laboratory]]

(ibid.: 90–91)

The examples in (5) and (6) show the left-branching compounds and the right-branching compounds, respectively. In (5), we find the compound stress pattern between the first and the second element, and they form a phonological unit. On the other hand, in (6) the compound stress pattern is found between the second and the third element and they form a phonological unit.

As far as there is no discrepancy between grammatical structure and phonological structure, the stress patterns in compounds are accounted for by the branching constraint. However, when there is discrepancy between them, as in (7), the branching constraint cannot handle it, repeated below:

- (7) a. [[parent-TEACHER] association]
- b. [[Tom PAINE] Street]
- c. [[Second LANGUAGE] Conference]

(= 1)

² Cinque (1993) investigates the stress pattern of English compounds in terms of metrical grid theory (Lieberman 1979).

The examples in (7) consist of a left-branching structure and have the main stress on the second element, which are observed in the right-branching compounds. Thus, the branching constraint cannot capture the mismatch between grammatical structure and phonological structure in English compounds.

As observed by Ladd (1984), the mismatch in (7) is related to a semantic constraint, which restricts the occurrence of a compound stress. According to Ladd, when compounds involve place names or proper names, for example, they do not take a compound stress pattern, as in (8a, b). Kubozono (1993: 41), moreover, points out that when compound nouns involve a coordination relation, as in (8c), they do not take a compound stress pattern:

- | | |
|----------------------|---------------------|
| (8)a. Madison AVENUE | (Ladd 1984: 261) |
| b. Franklin STOVE | (ibid.: 262) |
| c. producer-DIRECTOR | (Kubozono 1993: 41) |

Turning back to example (7), the mismatch in (7) can be explained by semantic constraints. Since (7a) includes a coordination relation and (7b) a proper name, they do not involve a compound stress pattern.

The mismatch between grammatical structure and phonological structure of English compounds can be accounted for by the constraints that we have seen above. We shall show that our proposal integrates these constraints and our analysis will offer a unified account for the mismatch phenomenon.³

2.2 Japanese Compound Nouns

Since Kubozono (1993, 1995) and Sadanobu (1997, 1999, 2000) investigate a mismatch between the syntactic and phonological structure in Japanese compound nouns most thoroughly of several previous studies, we shall focus on their analyses in this subsection.

2.2.1 Kubozono (1993, 1995) Let us first look at Kubozono (1993, 1995). He proposes the three constraints which concern the process of the compound noun formation, as seen above; semantic constraint, branching constraint, and rhythmic constraint. The semantic constraint in Japanese is described in terms of the grammatical structure that illustrates phonologically non-unified compounds. Let us consider the following examples:

- (9)a. kaku daigaku
 each university

³ As pointed out by Kubozono (1993), phonological groupings of English and Japanese compounds are affected by a rhythmic pattern when they consist of four elements. We will see rhythmic constraint in 2.2.1.

- ‘each university’
 b. hon daigaku
 book university
 ‘this university’
 c. too zai nan boku
 east west south north
 ‘north, south, east, and west’
 d. katsu kaisyuu
 ‘Katsu Kaisyuu’

If the compound includes a kind of prefix-type morphemes in the initial position *kaku* ‘each’ or *hon* ‘book’ in (9a) and (9b), respectively, it is not pronounced in compound accent. Likewise, if each element that composes a compound enters into a parallel relation, as in (9c), or the compound represents a personal name, as in (9d), the compound is not unified phonologically.

Second, the branching constraint predicts that the three-element compounds involving the right-branching structure, for example, have a phonological boundary between the first and second elements:

- (10) a. [ni'chibei [a'npō jooyaku]]
 Japan-U.S. security treaty
 ‘Japan-U.S. Security Treaty’
 a.’ || ni'chibei || anpo jo'oyaku ||
 b. [na'gōya [ko'ogyō daigaku]]
 Nagoya industry university
 ‘Nagoya Institute of Technology’
 b.’ || na'gōya || koogyō da'igaku ||

The examples in (10) consist of the right-branching structure, and the second and third elements are unified phonologically.

Finally, the rhythmic constraint accounts for the following examples:

- (11) a. [[[toonan a'jia] sho'koku] rengō]
 south-east Asia nations union
 ‘The Association of Southeast Asia Nations (ASEAN)’
 a.’ || toonan a'jia || shokoku re'ngo ||
 b. [[[sa'n kootai] ki'nmu] se'ido]
 three shift work system
 ‘three-shift work system’
 b.’ || sanko'otai || kinmuse'ido||

The examples in (11) consist of four elements and they are left branching. They are grouped into two parts because monotonous patterns tend to be avoided.

Kubozono applies the three constraints that we have seen above and explains mismatch phenomena. Although his analysis accounts for the examples that have been presented above, it cannot explain why there are many cases in which there exists a

phonological boundary after the initial noun.

2.2.2 *Sadanobu (1997, 1999, 2000)* In course of compound-noun production, Sadanobu (1997, 1999, 2000) assumes that when the speaker utters a word he/she predicts the following noun, in other words, the speaker keeps in mind only two linguistic chunks. Let us consider his assumption by using the following examples:

- (12) a. [kansai [kokusai kuukoo]]
 Kansai international airport
 ‘Kansai International Airport’
 a.’ || ka’nsai || kokusai ku’ukoo ||
 b. [[nihon ruumania] kankei]
 Japan Romania relation
 ‘Relations between Japan and Romania’
 b.’ || niho’n || ruumania ka’nkei ||

According to Sadanobu’s analysis, example (12b) is explained as follows: in (12b), which involves a mismatch phenomenon, the speaker ‘mentally looks at’ two nouns *nihon* ‘Japan’ and *ruumania* ‘Romania’ when he/she determines whether the former should be uttered with a compound accent.⁴ Since these words have the same grammatical relation, *nihon* is not uttered with a compound accent. In turn, the speaker envisages two nouns *ruumania* and *kankei* ‘relation’ when he/she determines whether the former should be uttered with a compound accent. Since *ruumania* and *kankei* consist of a modifier-modifiee relation, the former is pronounced with a compound accent. Finally, the speaker refers to *ruumania* and *kankei* again when he/she determines whether the latter should be uttered with a compound accent. Since they consist of a modifier-modifiee relation, as we saw above, the latter is pronounced with a compound accent. Therefore accent is compounded between *ruumania* and *kankei*, not between *nihon* and *ruumania*.

Let us next examine (12a), which shows no discrepancy between a grammatical and phonological structure. The speaker envisages two nouns *kansai* ‘Kansai’ and *kokusai* ‘international’ when he/she determines whether the former should be uttered with a compound accent. Sadanobu (2000) assumes that the word *kansai* specifies the domain of *kokusai kuukoo* ‘international airport’ rather than the former modifies the latter and the former is not pronounced with a compound accent. In turn, the speaker refers to two nouns *kokusai* and *kuukoo* ‘airport’ when he/she determines whether the former should be uttered with a compound accent. Since *kokusai* and *kuukoo* consist of a modifier-modifiee relation, the former is pronounced with a compound accent. Finally, the speaker looks at *kokusai* and *kuukoo* again when he/she determines whether *kuukoo* should be uttered with a compound accent. Since they consist of a modifier-modifiee relation, as we saw above, the latter is pronounced with a compound accent.

⁴ Japanese has two accent rules. One is that the first mora is different from the second one in height. The other is that once accent changes from high to low, it never changes from low to high (Sadanobu 2000).

We agree with his assumption that what he calls ‘scanning’ plays an important role in capturing compound-noun production, but disagree with his assumption that the linguistic chunks that the speaker envisages are two. We wonder whether the linguistic chunks are always two because the entrenched expressions tend to be connected and there are cases in which they consist of more than two.

2.3 Summary

So far, we have provided an overview of the previous analyses to English and Japanese compound nouns. Although the constraints that Ladd or Kubozono offered seem to be correct, they cannot explain the question of why the last and the penultimate elements tend to be unified phonologically.

As for Japanese compounds, we have seen two major analyses for mismatch phenomena. Kubozono proposes three constraints and Sadanobu hypothesizes the special machinery to explain such phenomena. Although their analyses are partially successful theory-internally, they cannot account for the question of why Japanese compound nouns tend to have a phonological boundary after the first element and the final and penultimate elements tend to be compounded.

In the next section, we would like to show that the cognitive concepts and the constructional schema, which we propose, account for mismatch phenomena and provide an answer for the aforementioned question.

3 THEORETICAL ASSUMPTIONS

Our analysis is based on the tenets of Construction Grammar and Cognitive Grammar, as seen in the analysis of Välimaa-Blum (2005).⁵ In Goldberg’s (1995) constructional view of grammar, a construction is defined as follows:

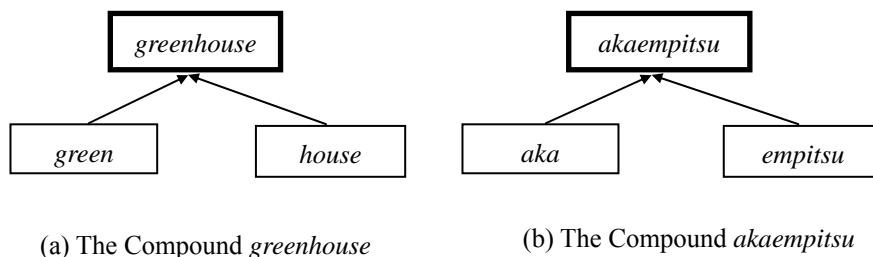
- (13) C is a CONSTRUCTION iff_{def} C is a form-meaning pair $\langle F_i, S_i \rangle$ such that some aspect of F_i or some aspect of S_i is not strictly predictable from C’s component parts or from other previously established constructions.
(Goldberg 1995: 4)

On the other hand, Langacker does not put such a restriction on a construction and assumes that constructions are complex expressions which can be analyzed into component parts, which is adopted in this paper.⁶

In this paper, we assume that a compound forms a kind of construction, as illustrated by the following figure:

⁵ Lakoff (1993) makes a proposal on phonology in a connectionist style.

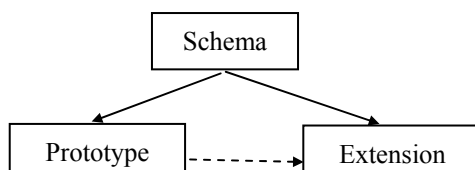
⁶ The comparison between Construction Grammar and Cognitive Grammar is discussed by Croft and Cruse (2004: Ch. 10), Langacker (2005), Goldberg (2006: 213–217), and Evans and Green (2006: 660).



<Figure 1> English and Japanese Compounds

Figure 1(a) indicates the integration of the adjective *green* and the noun *house*, and they compose the compound *greenhouse*, which represents a structure enclosed by glass. The bold line indicates that the meaning of a compound is not predictable from its component parts. Likewise, Figure 1(b) represents the integration of the adjective *aka* ‘red’ and the noun *empitsu* ‘pencil’ in Japanese and they compose the compound *akaempitsu* ‘red-wax pencil,’ which represents a pencil that has a red lead, not the one that has a red outer covering. Thus, a compound is regarded as a conventionalized meaning-form pair.

Another important point in this paper is that we are based on a usage-based model assumed by Langacker (1987, 1991, 1999) and Bybee (2001). A usage-based model emphasizes the importance of the actual use of the linguistic system, and it can be described in terms of a schematic network proposed by Langacker (1987). According to Langacker, all linguistic units are abstracted from usage events. For example, the verb *send* is related to the English ditransitive construction and they compose a network, which locates the prototypicality of the schematic symbolic assembly. These relationships are understood by assuming the following diagram:



<Figure 2> A Schematic Network (Langacker 1990: 271)

In the diagram, the solid arrows stand for instantiation and the dashed arrow represents extension. It indicates that a more specific structure instantiates the schema, and if there is an entity similar to the prototype, it is included in a category as its extension by means of our cognitive ability.

Also, in our model, Japanese compounds are captured in terms of entrenchment in the sense of Langacker (1999). This means that a word that occurs frequently in use

is fixed and established as a unit. We will claim that this notion is important in capturing English and Japanese compounds.^{7,8}

4 ANALYSIS

4.1 A Constructional Approach to English Compounds

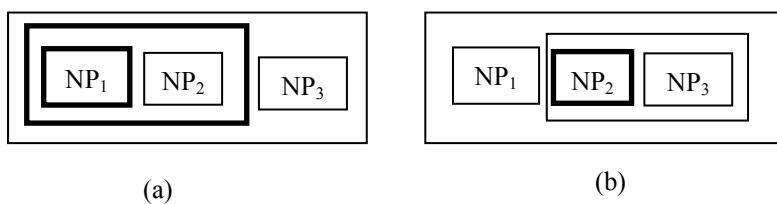
In 2.1, we have seen that when English compounds are left branching, they usually have a compound stress on the first element, whereas when they are right branching, they have on the second element. Examples are repeated below:

- (14) a. [[COMPUTER class] instructor]
 b. [[COMMUNITY center] building]
 c. [[LIGHThouse] keeper] (Kubozono 1995: 90)
- (15) a. [evening [COMPUTER class]]
 b. [theater [TICKET office]]
 c. [kitchen [TOWEL rack]]
 d. [supermarket [DELIVERY service]]
 e. [chemistry [RESEARCH laboratory]] (ibid.: 90–91)

We agree with the idea that the grammatical relation is related to the compound stress pattern, such as the branching constraint. What I would like to emphasize here is that “left-branching” structure is more connected to the adjacent element, because that structure is unmarked. More specifically, since in (14) the first and the second element are readily connected, the compound stress pattern is found between them. On the other hand, since in (15) the second and the third element are readily connected, the compound stress pattern is found between them. The phonological structures of (14) and (15) are schematized as in Figure 3:

⁷ Croft (1995) examines the relation between intonation units and grammatical units, and suggests that the degree of entrenchment plays a role in capturing it.

⁸ Spencer (1988) discusses bracketing paradoxes in terms of morphology and mentions that ‘paradoxes can only be formed from members of the permanent lexicon’ (ibid.: 675). Although we investigate the mismatch in terms of phonology, the idea that entrenchment is one of the factors that produce the mismatch phenomena may be supported by that analysis.

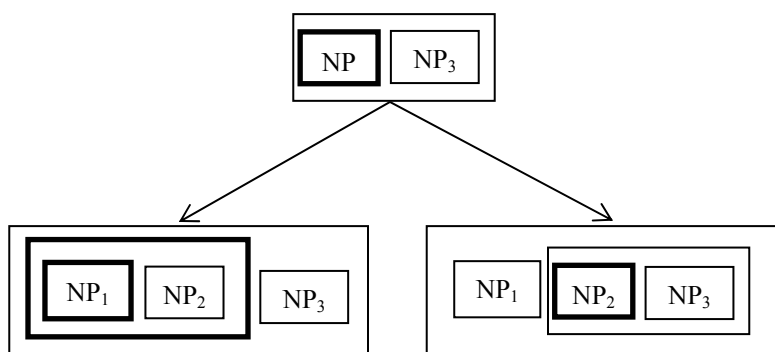


<Figure 3> The Constructional Schema for (14) and (15)

In Figures 3(a, b), the bold box represents the position of the compound stress. In Figure 3(a), NP₁ and NP₂ are phonologically connected and then the phonological unit [NP₁ NP₂] and NP₃ are unified. In Figure 3(b), on the other hand, NP₂ and NP₃ are phonologically connected because of its grammatical relation. From this idea we hypothesize the following generalization:

- (16) In English compound nouns, the last element is phonologically unified with the penultimate one, unless the latter is grammatically connected with the preceding element. If the penultimate element is grammatically connected with the preceding one, they compose a phonological unit and its composite unit is phonologically unified with the last element.

Let us consider how (16) captures the examples in (14) and (15). In (14), the penultimate element (NP₂) is grammatically connected with the antepenultimate one (NP₁) and its composite unit is phonologically unified with the last element (NP₃), as depicted in Figure 3(a). In contrast, in (15) the last element (NP₃) is phonologically unified with the penultimate one (NP₂) because the first element, NP₁, modifies the unit [NP₂ NP₃] grammatically, as depicted in Figure 3(b). The schematization of Figure 3(a, b) is represented by the following figure:



<Figure 4> The Schematization of Figures 3(a, b)

In Figure 4, it is shown that the commonality of Figure 3(a, b) is abstracted. Note that the super-schema in Figure 4 has the pattern of compound stress, [Strong Weak]. We argue that in the default case, the component of compound nouns has the structure of [Strong Weak] in the final position.⁹

Concerning the examples involving a mismatch, as pointed out by the previous studies, the nouns that compose compounds are semantically idiosyncratic in the sense that *parent* and *teacher* in (17a) are in parallel relation and (17b) contains a proper name. (17c) may be semantically idiosyncratic in the sense that it includes an ordinal number. Although we do not disagree with the idea that the semantics of compounds is concerned with the mismatch, we wonder how many semantic constraints we need. We rather argue that compound nouns have the super-schema diagrammed in Figure 4 and it is applied to the examples in (17):

- (17) a. [[parent-TEACHER] association]
 b. [[Tom PAINE] Street]
 c. [[Second LANGUAGE] Conference]
- (= 1)

Finally, let us consider compounds consisting of four elements. We argue that Figure 4 captures the phonological structures of such compounds:¹⁰

- (18) a. [[law degree] [LANGUAGE requirement]]
 b. [[labor union] [FINANCE committee]]
 c. [evening [COMPUTER class]] instructor]
 d. [theater [TICKET office]] manager]
- (Kubozono 1993: 47)
- e. [surprise [[SEX change] [operation]]]
 f. [world [amateur [BASEBALL championship]]]
- (Kubozono 1995: 92)

In (18a, b), the first and second elements are unified and the third elements have the compound stress by the unification of the penultimate and the last elements. In (18c-e), the second and the third elements are unified because the first elements modify each composite unit grammatically. The same reasoning is true of (18f). All examples in (18) conform to Figure 4.

In sum, what we have argued in this subsection is that English compound nouns have the constructional schema which represents the phonological unification of the last element and the penultimate one, and when the penultimate element is connected with the preceding one grammatically, its composite unit is regarded as the

⁹ As seen in (i), repeated here, when the compound is interpreted in two ways, it can have the stress pattern [Weak Strong]:

(i) blackboard

¹⁰ Although Figure 4 shows the schematization of the compounds that consist of three elements, it is also applied to the four-element compounds.

- c.' || A || B C D ||
- (23) a. [ni'chibei [[anzen hoshoo] jooyaku]] (Kubozono 1993: 52)
 Japan-U.S. security guarantee treaty
 'Japan-U.S. Security Treaty'
- a.' || ni'chibei || anzen hoshoo jo'oyaku ||
- b. [A [[B C] D]]
- b.' || A || B C D ||

While (19-23) take [[A B] C], [A [B C]], [[A [B C]] D], [[[A B] C] D], and [A [[B C] D]] as the grammatical structure, respectively, all of them have a phonological boundary after the initial noun and the other elements are connected phonologically.

Notice that the initial noun of compound nouns does not have a case marker. Turning to the examples in which the initial noun is not marked by a case, we find the sentences which include the so-called *teejigo* such as the following:

- (24) a. Doitsugokoodoku, mattaku tsumaranai jugyoo-o eranda-monda.
 German.reading really boring subject-Acc chose-modal
 'German reading, what a totally boring subject I chose!'
- b. Yuugure-no kyooshitsu, yooko-wa hitori haha-o matteita.
 twilight-Gen classroom Yoko-Top alone mother-Acc was-waiting
 'At twilight in the classroom, Yoko was waiting for her mother alone.'
 (Nakamura and Yoshimoto 2001: 167–168)

The nominal *doitsugo kodoku* 'German reading' in (24a) and *yugure-no kyoshitsu* 'at twilight in the classroom' in (24b) are traditionally called *teejigo* (a presented word) in the field of Japanese linguistics, which is extraposed in the sentence-initial position. Notice that there is a phonological boundary after the initial nominal in (24a, b).

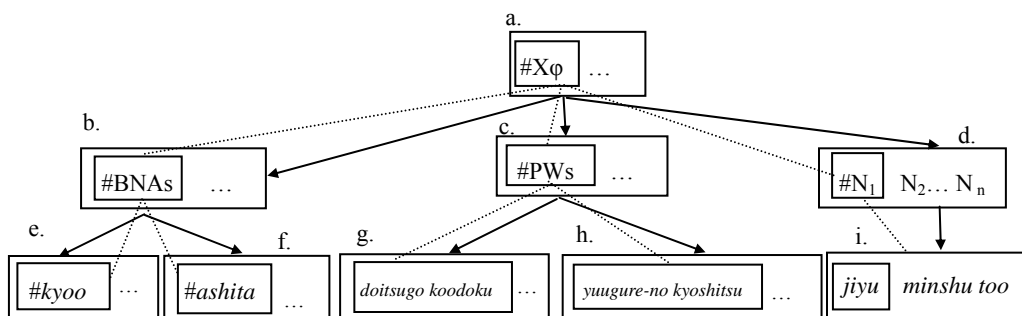
Also, Japanese has so-called bare-NP adverbs, such as *kyoo* 'today' or *ashita* 'tomorrow,' which are not marked by a case, as indicated in (25):

- (25) a. Kyoo Taroo-ga Hanako-o tataita.
 Tomorrow Taro-Nom Hanako-Acc hit
 'Today Taro hit Hanako.'
- b. Ashita Taroo-ga Hanako-to tenisu-o suru.
 Tomorrow Taro-Nom Hanako-with tennis-Acc do
 'Tomorrow Taro will play tennis with Hanako.'

After *kyoo* and *ashita* in (25a, b), respectively, we find phonological boundaries.

Based on the observation so far, we propose the following schemas which are described in terms of the characteristics of the initial BNP:¹²

¹² Adopted for expository convenience, in the following figures, we employ the notation "φ," which is used to represent nouns that are not case-marked.



<Figure 5> The Network of the Initial BNP

In Figure 5, the high-level schema [#Xφ...] in the topmost box (Figure 5a) indicates that an X is a BNP and it is located in the initial position in the clause or phrase. The schema [#Xφ...] embodies phonological, morphological, and grammatical commonalities inherent in Figure 5(b-d). In terms of grammatical structure, they are located in the initial position of a phrase or sentence. Morphologically they are not marked by a case, and phonologically they have a boundary immediately after it. The semantics of Figure 5(a) is very schematic and indicates nothing more than attracting attention.

Examining each figures in turn, first, Figure 5(b) [#BNAs...] represents the schema of so-called bare-NP adverbs and is abstracted from Figure 5(e) and 5(f), for example. Second, Figure 5(c) [#PWs...] stands for the schema of *teejigo* ‘presented words’ in the clause or phrase initially. It is abstracted from Figure 5(g) and Figure 5(h), for example. Finally, Figure 5(d) [#N₁ N₂... N_n] represents compound nouns and [#N₁] is a noun in the phrase-initial position. It instantiates the schema [#Xφ...] in Figure 5(a) and is instantiated by Figure 5(i), for example.

4.2.2 Phonological Unification of the Penultimate and the Last Word Let us next focus on the morphological form of Japanese compound nouns. We notice that they consist of the categorically same forms which are combined successively. We find that nested relative clauses, as in (26), are categorized into the same group as compound nouns in this respect:

- (26) a. [Kore-wa [[[chiizu-o tabeta] nezumi-o] tabeta]neko-da].
 this-Top cheese-Acc ate mouse-Acc ate cat-be
 ‘This is the cat that ate the mouse that ate the cheese.’
 b. || kore-wa || chiizu-o tabeta || nezumi-o tabeta neko-da ||

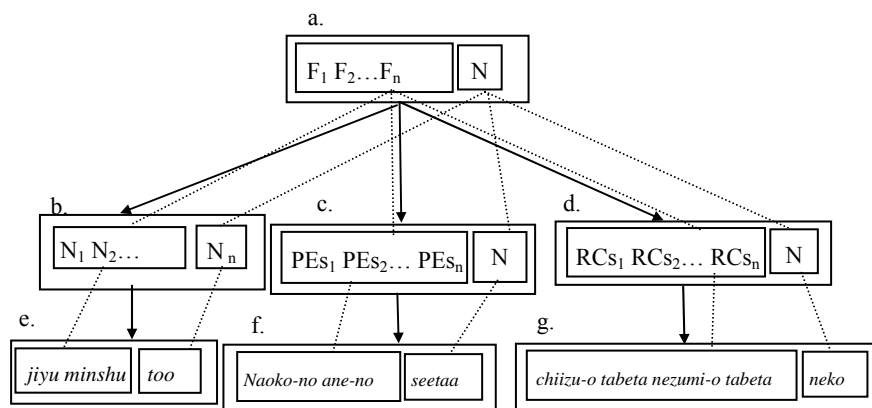
Also, we categorize successive possessive expressions, as in (27), into the same group as compound nouns in the sense that the categorically same forms follow:

- (27) a. [Naoko-no [ane-no [seetaa]]]
 Naoko-Gen sister-Gen sweater
 ‘Naoko’s sister’s sweater’
 a.’ || Naoko-no || ane-no seetaa || (Kubozono 1995: 133)
 b. [[Taro-no neko-no] shippo] (-o funda)
 Taro-Gen cat-Gen tail (-Acc trod)
 ‘Taro’s cat’s tail’
 b.’ || Taro-no || neko-no shippo || (-o funda)

Schematically, the structures of nested relative clauses (RCs), successive possessive expressions (PEs), and a noun compound are represented in (28a, b) and (29), respectively. Furthermore, they are schematized as in (30):

- (28) a. [RC_{s1} RC_{s2}... RC_{sn}N]
 b. [PE_{s1} PE_{s2}... PE_{sn} N]
 (29) [N₁ N₂... N_n]
 (30) [F₁ F₂... F_nN]

In (30), F stands for a form and the schema shows that the categorically same form is repeated. This schematization is illustrated by the following diagram:

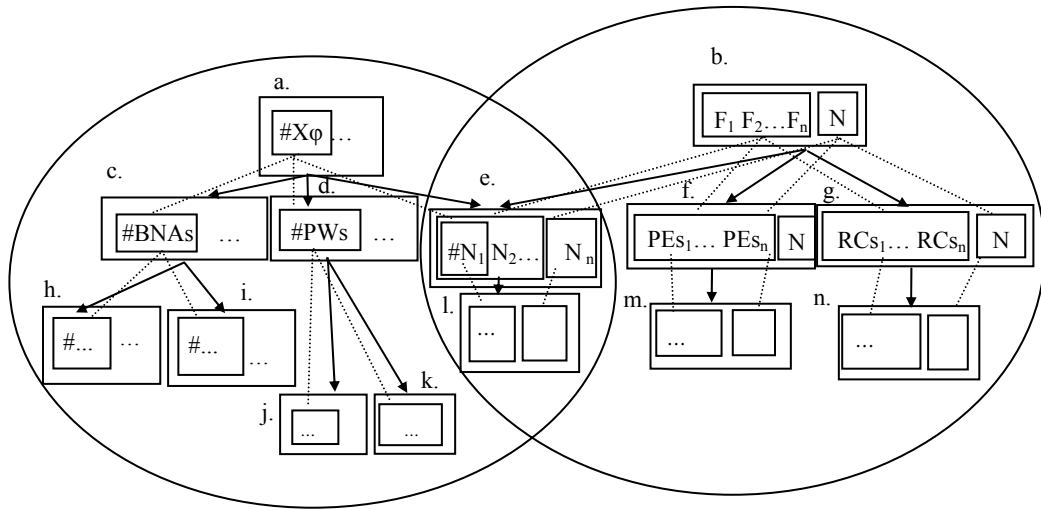


<Figure 6> The Schematization of (29)

Figure 6 represents a network of the nominal phrases that have the categorically same form. In this figure, 6(e), 6(f), and 6(g) instantiate 6(b), 6(c), and 6(d), respectively, and they instantiate the higher-level schema 6(a). The noun compound can be captured by the instantiation of 6(a) in this figure.

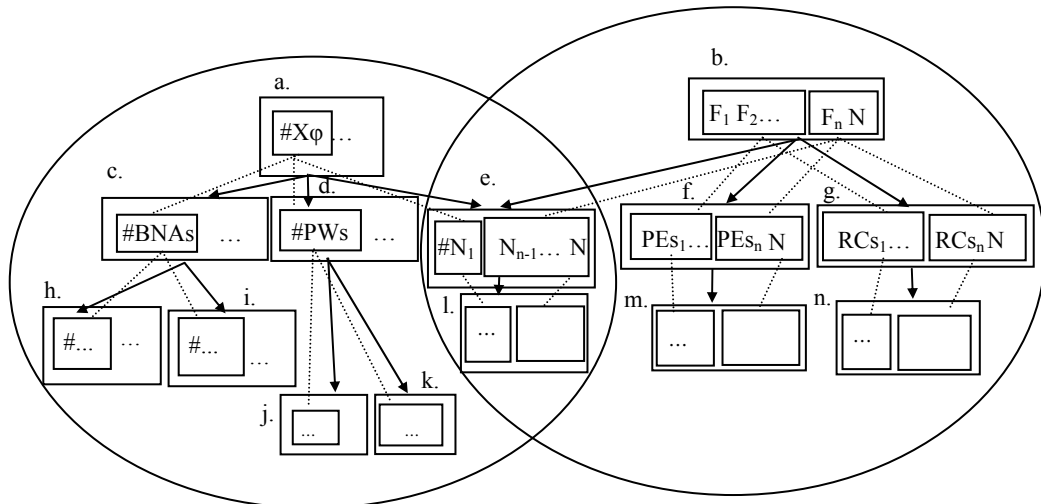
4.2.3 A Phonological Network of Japanese Compound Nouns

So far, we have proposed Figures 5 and 6 which are based on a morphological property and the property of grammatical structure, respectively. We assume that Japanese compound nouns can be captured in terms of a commonality shared between Figures 5 and 6, and they are illustrated by using a network model, as follows:



<Figure 7> The Network of Japanese Compound Nouns
on the basis of the Morphological Properties

Notice that when the categorically same form is repeated the penultimate word or phrase tends to be unified with the last noun phonologically, as seen in the examples (26) and (27). In the phonological groups // *nezumi-o tabeta neko-da* // ‘is the cat that ate the mouse’ in (26) and // *ane-no seetaa* // ‘sister’s sweater’ in (27a), the nested clause *nezumi-o tabeta* ‘ate the mouse’ and the genitive *ane-no* ‘sister’s’ in (26) and (27a), respectively, compose one phonological group with the modified nouns *neko* ‘cat’ and *seetaa* ‘sweater,’ respectively. Based on this observation, we propose a network of Japanese compound nouns on the basis of phonological properties:



<Figure 8> The Network of Japanese Compound Nouns
on the basis of the Phonological Properties

On the left in Figure 8, which is enclosed in an ellipse, the first element is also differentiated from the other part of the phrase or sentence phonologically. In other words, it shows that there is a phonological boundary after the first element. On the right in Figure 8, it is shown that the last word or phrase is unified with the penultimate one phonologically. Figure 8 claims that Japanese compound noun is at the intersection of the right and left ellipse, and shares phonological properties with them.

Now the proposed network can provide an explanation for a mismatch between grammatical structure and phonological structure in Japanese compound nouns. As we saw in 4.2.1, in the examples (19) and (20), repeated below, three-element compounds have a phonological boundary after the initial noun. At the same time, it is also identified with the boundary before the penultimate noun:

- (31) a. [[[[jiyu minshu] too] taikai]
 a.' || jiyu'u || minshu too ta'ikai ||
 b. [[[marukusu reenin] shugi] shisoo]
 b.' || ma'rukusu || reenin shugi shi'soo ||
 c. [[koomu shikoo] boogai]
 c.' || ko'omu || shikoo bo'ogai ||
- (= 19)
- (32) a. [na'goya [ko'ogyoo daigaku]]
 a.' || na'goya || koogyoo da'igaku ||
 b. [ni'chibei [a'npō jooyaku]]
 b.' || ni'chibei || anpo jo'oyaku ||
- (= 20)

Since all of these examples consist of three elements and have a phonological boundary after the initial noun, they are accounted for by Figure 8.

Let us turn to four-element compounds. The following example is also accounted for by Figure 8:

- (33) a. [ki'ndai [niho'n [jojoo bu'ngaku]]]
 modern.times Japan lyricism literature
 'modern Japanese lyric literature'
 b. || ki'ndai || niho'n || jojoo bu'ngaku ||
- (Kubozono 1993: 36)

(33) shares commonalities with the right and left ellipse in the sense that it has phonological boundaries after the initial noun and before the penultimate noun. It is explained by Figure 8.

Notice that the following examples do not have a phonological boundary after the initial element:

- (34) a. [[ke'izai taisaku] [kakuryoo ka'igi]]
 economy measures Cabinet member meeting

- ‘Cabinet meeting on economic measures’
- a.’ || keizai ta’isaku || kakuryoo ka’igi || (Kubozono 1993: 51)
- b. [[A B] [C D]]
- b.’ || A B || C D ||
- (35) a. [[[toonan a’jia] sho’koku] rengoo]
 south-east Asia nations union
 ‘The Association of Southeast Asia Nations (ASEAN)’
- a.’ || toonan a’jia || shokoku re’ngo || (ibid.: 55)
- b. [[[A B] C] D]
- b.’ || A B || C D ||

Both (34) and (35) have a phonological boundary after the second element, although the grammatical structure is different. We argue that *keizai taisaku* ‘economy measures’ or *toonan ajia* ‘south-east Asia’ are entrenched in the sense of Langacker (1999). Since they are not right branching, the first element is readily unified with the second element, in contrast to (33). The claim that they are entrenched is demonstrated by the following three-element compounds:

- (36) a. [[ke’izai taisaku] [ka’igi]]
 economy measures meeting
 ‘Meeting on economic measures’
- b. || keizai taisaku ka’igi || (Kubozono 1995: 88)
- (37) a. [[toonan a’jia] boeeki]
 south-east Asia trade
 ‘southeast Asia trade’
- b. || toonan ajia bo’oeki ||

(36) and (37) show *keizai taisaku* and *toonan ajia* are entrenched and they do not have a phonological boundary after the initial noun even though they consist of three elements.

The following four-element compounds are also captured by the notion of entrenchment:

- (38) a. [[ze’nkoku [yo’ron cho’osa]] kekka] (= 21a)
- b. || ze’nkoku || yoron choosa ke’kka ||
- (39) a. [[[jiyu minshu] too] taikai] (= 22a)
- a.’ || jiyu’u || minshu too ta’ikai ||
- b. [[[marukusu reenin] shugi] shisoo] (= 22b)
- b.’ || ma’rukusu || reenin shugi shi’soo ||
- (40) a. [ni’chibei [[anzen hoshoo] jooyaku]] (= 23a)
- b. || ni’chibei || anzen hoshoo jo’oyaku ||

Note that the second element *yoron* ‘opinion’ and the third element of *choosa* ‘survey’ in (38) are highly connected semantically. We argue that this semantic connection makes them unified phonologically and they are captured as one word. That is why

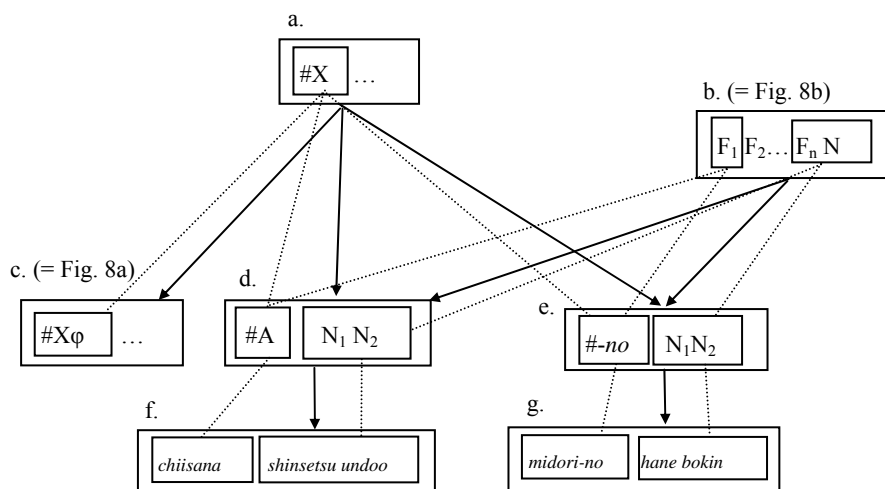
there is no phonological boundary after the second element. Likewise, since *minshu too* ‘democratic party’ in (39a) and *anzen hoshoo* ‘security’ in (40) are entrenched, these examples do not have a phonological boundary after each second element.

4.2.4 *Beyond Compound Nouns* According to Kubozono (1995), there are examples other than compound nouns that yield a mismatch:

- (41) a. [[chiisana shinsetsu] undoo] (-ni sankasuru)
 little kindness campaign (-Dat participate)
 ‘little kindness campaign’
 a.’ || chiisana || shinsetsu undoo ||
 b. [[midori-no hane] bokin] (-ni kyooryokusuru)
 green-Gen feather fund-raising (-Dat cooperate)
 ‘Green Feather Fund’
 b.’ || midorino || hane bokin ||
 c. [[senzo-no haka]] mairi] (-o suru)
 ancestor-Gen grave visiting (-Acc do)
 ‘visiting one’s ancestor’s grave’
 c.’ || senzono || haka mairi ||

(Kubozono 1995: 129)

In (41a), the adjective *chiisana* ‘little’ modifies the noun *shinsetsu* ‘kindness’ and combines with it semantically, while the former is separated from the group *shinsetsu undoo* ‘kindness campaign’ phonologically. Likewise, although *midori-no* ‘green-Gen’ in (41b) and *senzo-no* ‘ancestor-Gen’ in (41c) modify *hane* ‘feather’ and *haka* ‘grave,’ respectively, and each of them composes a grammatical group with the second element, they do not constitute a joint phonological group. Sentences (41a-c) do not meet the network that was presented above because the initial noun is not bare or the compound noun does not consist of the successive same forms. Focusing on the initial elements of these examples, a super-schema is abstracted and it is instantiated by further examples, as illustrated in Figure 9:



<Figure 9> The Network of the Initial Element

In Figure 9, a super-schema [#X...] stands for the initial word, bare or not bare. It is instantiated by the phrases [#A N₁N₂] and [#-no N₁N₂]. The former represents a phrase where the initial word is an adjective and the latter the phrase that is case-marked by the genitive marker *-no*. Notice that since they include the categorically same forms they are linked to Figure 8(b). We argue that there is a phonological boundary after the initial element because of the super-schema and there is not a phonological boundary before the final element because Figure 8(b) has this property and it is instantiated as Figure 9(d) and 9(e).

So far, we have seen the same pattern of phonological grouping as the compound noun. As indicated by the following examples, there are cases in which this is not always the case:

- (42) a. [[*utsukushii natsuyama*] tozan] (-o tanoshimu)
 beautiful mountains.in.summer mountaineering(-Acc enjoy)
 ‘beautiful summer mountaineering’
 a.’ * || *utsukushii* || *natsuyama tozan* ||
 b. [[*mezurashii hana*] zukuri] (-ni hagemu)
 rare flower making (-Dat work.on)
 ‘making rare flowers’
 b.’ ?? || *mezurashii* || *hana zukuri* ||

(Kubozono 1995: 134)

In (42a), the adjective *utsukushii* ‘beautiful’ modifies *natsuyama* ‘mountains in summer’ grammatically, while the former does not make a different grouping from the latter phonologically. In similar fashion, the adjective *mezurashii* ‘rare’ in (42b) composes a grammatical grouping with the noun *hana* ‘flower,’ while the former tends to be associated with the latter phonologically. We consider that if (42a’) is uttered, it can be interpreted as the meaning that summer mountaineering is beautiful,

although it is hard to obtain this interpretation. As for (42b'), it can be interpreted as the meaning that floriculture, not a flower, is rare. We assume that if a phonological grouping on the basis of the schema in Figure 9 makes a hearer interpret a phrase wrongly, a grammatical grouping is preserved.

5 CONCLUSION

In this paper, we have examined a mismatch between the phonological structure and grammatical structure of English and Japanese compound nouns. Firstly, it was claimed that in English compound nouns the last element is phonologically unified with the penultimate one and when the penultimate element is connected with the preceding one grammatically, its composite unit functions as the 'penultimate' element of a compound. Secondly, we argued that Japanese compound nouns are captured by focusing on the observation that they have a commonality between the pattern of initial BNPs and the pattern in which the categorically same forms are repeated. The proposed network accounts for why there are many cases in which a phonological boundary exists after the initial noun, and why the final and penultimate elements tend to be compounded without constraints or special apparatuses.

Finally, we would like to mention that in the constructional schema of both English and Japanese compound nouns, the last element is unified with the penultimate one, although the phonological composite unit is regarded as the penultimate element when the latter is connected with the preceding one grammatically. Although English is different from Japanese in that the former has stress accent and the latter pitch accent, they show a similarity in the phonological unification of the last and the penultimate element.

We have put Japanese compounds in the networks that include sentences and phrases. In other words, Japanese compounds are analyzed in parallel with sentences and phrases. Although one may question such an approach because compounds are idiosyncratic in several respects, this paper has shown that compounds can be captured dynamically by adopting a network model.

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