

An HPSG approach to English comparative inversion

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Abstract

It has been analyzed that the word order of English comparative inversion is analogous to that of other subject-auxiliary inversions in that only a finite auxiliary verb can be followed by the subject. However, English comparative inversion should be distinguished from other inversions because the subject can be located between a cluster of auxiliary verbs and the non-auxiliary verb phrase in English comparative inversion. Existing analyses on subject-auxiliary inversion cannot account for this special kind of inversion. This paper proposes a new phrase type for English comparative inversion within the construction-based HPSG. In addition, I suggest that constraints on properties of lexemes participating in the new phrase type are governed by the construction-based approach, while the word order of English comparative inversion is determined by rules that the word order domain approach adopts. Also, it will be shown that these proposals can capture the word order of *nor*-inversion, *as*-inversion, and *so*-inversion as well as that of comparative inversion.

1. Introduction

English Comparative inversion (henceforth CI) has been analyzed in the same way as other inversions (Merchant 2003 and Maekawa 2007, among others). This is because both comparative inversion and other inversions seem to have the same word order: only a finite auxiliary verb can precede the subject as in (1).

- (1) a. Humans can climb trees more carefully than can monkeys. [CI]
b. Have you ever been to Seoul? [Interrogative inversion]
c. Not until the evening did John find his son. [Negative Inversion]
d. Had John finished his homework, he would be with us now. [If-less inversion]

However, Culicover and Winkler (2008) provide some examples indicating that, unlike other inversions, CI allows the subject to be preceded by more than one auxiliary verb as in (2).

- (2) a. Who was responsible for keeping the records would be a more reliable witness as to their accuracy as a whole than would be any of the original makers.

† I would like to thank Prof. Eun-Jung Yoo for her invaluable suggestions and advice. My gratitude also goes to three anonymous reviewers of this conference for their comments. All remaining errors are solely mine.

- b. To her, thinking, as she ever was thinking, about Johnny Eames, Siph was much more agreeable than might have been a younger man.
(Culicover and Winkler, 2008)

Also, a host of authentic data showing this fact can be found from books, the Web, and corpora such as the British National Corpus (BNC) and the Corpus of Contemporary American English (COCA) as follows.

- (3) a. It is no more expensive than would be the system you are proposing.
(Huddleston and Pullum, 2002)
- b. White women in our study would have used relatively more IAAT than would have the black women.
<The America Journal of Clinical Nutrition>
- c. The Relief and Aid Society was a genuinely civic-minded organization that very possibly did administer the world's contributions more efficiently and honestly than could have the city government.
<Urban disorder and the shape of belief>
- d. Her name on that list affected me more than would have divorces from a dozen Kathyrns.
(COCA)

These examples are quite challenging because existing explanations on subject-auxiliary inversion do not have any method to locate more than one auxiliary verb before the subject in subject auxiliary inversions. To be specific, T-to-C movement in Minimalist Program does not allow a cluster of auxiliary verbs to move to C. Additionally, *subject-auxiliary inversion phrase (sai-ph)* in Head-driven Phrase Structure Grammar also permits only a finite auxiliary verb to precede the subject.

The subjects in examples in (2) and (3) are located at the sentence final position, which causes some researchers to regard this inversion as Heavy NP Shift (HNPS). However, sentences in (4) illustrate that CI is not HNPS.

- (4) a. Ali would have driven a car to the park more eagerly than would have the students (in our class on environmental consciousness) to the concert.
(Potts, 2002)
- b. Jim would have translated the English much better than would have students in his class read the Spanish.
- c. John could have read French more fluently than could have Joe.
- d. Don would have been more proud of what he had achieved than would have been Bill.

In (4a) and (4b), each subject in comparative clauses is followed by PP and VP, respectively. If this inversion is HNPS, the subjects should be located at the sentence final position, adjoined to TP. Besides, the inverted subjects in (4c) and (4d) are one-word proper nouns. Even though it is difficult and

subtle to define to what extent 'heavy' can cover, it is unreasonable to consider the proper noun as heavy NP. Thus, the conclusion can be drawn that CI is not HNPS.

This paper aims to propose constraints for capturing the word order of English comparative inversion by suggesting a new phrase type within the construction-based approach. In addition, this paper suggests that the new phrase type should follow word order domain rules instead of the constituency that the construction-based approach adopts. I will also make a prediction that if other inversion constructions have the same conditions CI has, both other inversions and CI will have the identical word order and those inversions can be analyzed with the new phrase type. The last part of this paper will show how this prediction is borne out through *nor*-inversion, *so*-inversion, and *as*-inversion.

In Chapter 2, I will present recent studies on CI and their problems. In Chapter 3, I will propose a new approach to explain the word order of CI within the construction-based approach and introduce word order domain rules that can be applied to all phrases in English, including the new phrase for CI. In Chapter 4, it will be shown that how the new phrase and related rules can be applied to other inversions. Finally, I will present concluding remarks.

2. Previous studies on CI and problems

2.1. Culicover and Winkler (2008)

Culicover and Winkler (2008) discuss that a cluster of auxiliary verbs can be followed by the subject in CI for the first time. They mention four logical possibilities to derive the word order of CI as in (5).

- (5) a. The subject is in canonical subject position (e.g. Spec IP) and all of the verbs move to the left;
b. The subject is in canonical subject position and moves to the right.;
c. The subject is in canonical subject position, and everything in I' moves to the left of it;
d. The subject is in situ in Spec vP, and remains in situ.

They suggest that (5d) is the easiest and most plausible possibility in terms of both derivation and stipulations. They point out that even though (5c) is closely related to the assumption that Minimalist Program adopts for subject-auxiliary inversion – T-to-C movement, a problem is that it allows only a finite auxiliary verb to move to C.

In order for (5d) to be on the right track, they propose that *than* and *as* are all complementizers and can select TP without an EPP. This suggestion is

based on the fact that the order of auxiliary verbs and the subject in CI is totally identical to the order of them when the subject in the specifier position of vP does not undergo any movement.

They suggest that this suspension of an EPP is possible only when following three rules, based on Selkirk (2005), are satisfied.

(6) Align R(Comma, ip)

Align the right edge of a constituent type Comma Phrase in syntactic representation with the right edge of an ip in phonological representation.

(6) is indicative of the correspondence between clausal syntactic constituent and intonational phrase.

(7) Contrastive-Focus-dominate- Δ ip (FOC/ Δ ip)

The terminal string of a contrastive FOCUS constituent in syntactic representation correspond to a string containing the metrical prominence of an Intonational Phrase in phonological representation.

(7) demonstrates that there is a close relationship between contrastive focus and metrical prominence of an ip.

(8) Right Edge Alignment of Focus (REAF)

Each focused element is right aligned in ip.

At last, (8) specifies the position where focus occurs - right edge of ip.

Examples in (9) show that whether three constraints are satisfied can result in two different comparatives. Capitalization signals the metrical prominence.

- (9) a. ?Anna ran much faster (than could have MANNY)_{ip}.
b. Anna ran much faster (than MANNY could have)_{ip}.

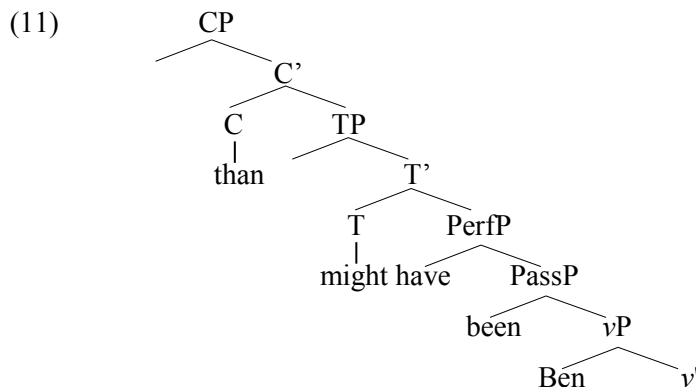
In (9a), three constraints are conformed. *Than could have MANNY* corresponds with an intonational phrase. In addition, the contrastively focused subject *MANNY* has a metrical prominence of ip and is right aligned in ip. These result in the EPP suspension. On the other hand, an EPP is not suspended in (9b), since this sentence violates the REAF which prevents the subject from moving to spec,TP. In brief, they suggest that an EPP competes with REAF. Thus, the REAF is stronger than an EPP in CI, while an EPP is stronger than the REAF in canonical comparative.

However, this approach has a non-trivial objection. This analysis cannot explain the cases where auxiliary verb phrases are elided optionally as in (10).

- (10) John might have been injured much more severely

- a. than might have been Ben.
- b. than might have Ben.
- c. than might Ben.

Both (10b) and (10c) can be interpreted as (10a). The syntactic structure for (10a) can be roughly described as in (11).



The elided part in (10a) is some node under vP . In this case, it is not clear what node is elided and what licenses this ellipsis. In addition, if any further movement of the subject is not assumed, (10b) and (10c) cannot be produced when PassP and PerfP are elided respectively, since the subject *Ben* should be also deleted when auxiliary verb phrases go through VP-ellipsis. Even though a feature that triggers the displacement of the subject or a proper landing site is devised, it is no more than a stipulation unless further evidence is provided.

2.2. Maekawa (2007)

Based on Kathol (1995, 2000, 2001), which try to explain the linear word order of German by means of 'topological field' within HPSG, Maekawa (2007) suggests the distribution of domain elements in English as in (12). The distribution specifies what elements can occupy each field. As the name 'topological field' indicates, sentences are divided into fields and each field is occupied by certain domain elements.

(12) Distribution of domain elements in English

<i>first</i>	Matrix non-subject <i>wh</i> -phrases, Preposed negative phrases, etc.
<i>second</i>	Finite auxiliary verbs in subject-auxiliary inversion (SAI) sentences, Complementizers, Subordinate non-subject <i>wh</i> -phrases

<i>third</i>	Subjects
<i>fourth</i>	Finite verbs in non-SAI-sentences
<i>fifth</i>	Complements of the finite verb

To determine the word order of English, two additional Linear Precedence (LP) constraints are proposed. The first one is to deal with the order of fields as in (13) and the other has to do with the cardinality restriction imposed to the *first* and the *second* fields as in (14).

(13) Topological Linear Precedence Constraint for English

first < *second* < *third* < *fourth* < *fifth*

(14) Topological Uniqueness Condition

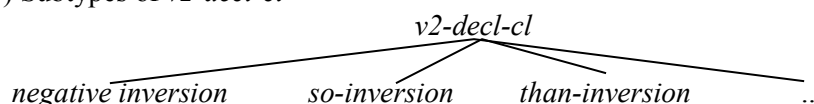
a. *first* < *first*

b. *second* < *second*

In (13), 'A<B' means that A is followed by B in linear order. For example, elements assigned to *first* topological field always precede those assigned to other topological fields. The other constraint (14) illustrates that the *first* and the *second* fields should contain only one element.

On the basis of the LP constraints mentioned above, Maekawa (2007) characterizes CI as an instance of declarative *verb-second clause* (*v2-decl-cl*) in which a finite auxiliary verb is located in the *second* field. The subtypes of *v2-decl-cl* are described as in (15).

(15) Subtypes of *v2-decl-cl*



These inversion types are classified according to what sort of element occupies the *first* field. In the case of *than-inversion*, the *first* field is occupied with *than*.

However, this approach is insufficient to capture the exact characters of CI. The problem is that it cannot license the cases where more than one auxiliary verb is followed by the subject. Generally, it is analyzed in HPSG that the non-finite auxiliary verb phrase following the finite auxiliary verb is the complement of the finite auxiliary verb. Then the complement of the first auxiliary verb should be located in the *fifth* field, according to (12). This cannot explain the way a cluster of auxiliary verbs precedes the subject in CI.

Even if we propose a new constraint allowing that auxiliary verbs can be placed before the subject, the problem still remains. Recall that the subject

should be contained in the *third* field and *than* is the element the *first* field should contain. Then, auxiliaries should be located in the *second* field. However, the constraint mentioned in (14) prohibits more than one auxiliary verb from occupying the *second* field.

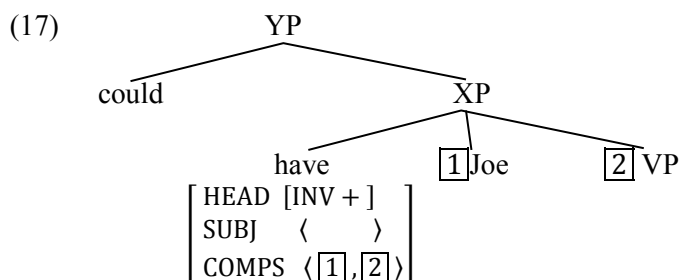
3. Proposals

Unlike other subject-auxiliary inversions, CI allows the subject to be preceded by a cluster of auxiliary verbs as in (16a). In addition, the inverted subject can be followed by the phrase with contrastive focus meaning as in (16b) and (16c).

- (16) a. Megan can jump higher than could have Bill.
 b. John read French more fluently than could have Joe spoken English.
 c. ?Mary would have been angry much longer than would have been John, happy.
 (Culicover and Winkler, 2008)

This chapter provides three possible options to account for the word order of CI. I propose that the best analysis among them is to make use of both the construction-based approach and the word order domain rules.

One of the possible options is to adopt the existing phrase rules. In this approach, the word order is determined by the constituency in local trees. In this respect, the brief syntactic representation of (16b) can be depicted as in (17).



In (17), the XP could be considered as *subject-auxiliary inversion phrase* (*sai-ph*) because only this phrase allows the subject to be located between the auxiliary verb and the non-auxiliary verb phrase among many phrases. In other phrases, subjects should be followed by verb phrases, according to the *head-subject phrase* rule. In the lexical entry of *have* in (17), the subject *Joe* is not specified in the SUBJ list, but in the COMPS list because of the subject-auxiliary inversion lexical rule as in (18).

(18) subject-auxiliary inversion lexical rule:

$$\left[\begin{array}{l} \text{HEAD } \textit{verb} [\text{AUX+}, \text{INV-}, \textit{fin}] \\ \text{SUBJ } \langle [N''[\textit{nom}]] \rangle \\ \text{COMPS } \boxed{1} \end{array} \right] \Rightarrow \left[\begin{array}{l} \text{HEAD } \textit{verb} [\text{AUX+}, \text{INV+}, \textit{fin}] \\ \text{SUBJ } \langle \quad \rangle \\ \text{COMPS } N''[\textit{nom}], \boxed{1} \end{array} \right]$$

(Pollard and Sag, 1994)

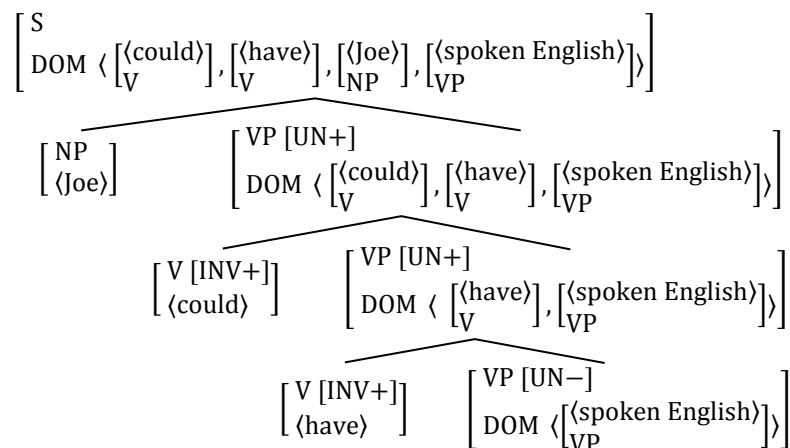
(18) states that the finite auxiliary verb in inversion takes its subject as a complement.

There are, however, two problems in this analysis. Firstly, XP is not *subject-auxiliary inversion phrase (sai-ph)* because the head of XP is not a finite verb. (18) shows that the head of *sai-ph* should be a finite verb. In addition, it is not clear what kind of phrase XP is. When the SUBJ value and the COMPS value are saturated, the phrase is not VP anymore, but a sentence. Yet, *have Joe spoken* is not a sentence in the sense that the head *have* is not a finite auxiliary verb. Secondly, it cannot be explained what rule licenses the combination of XP and its sister. Even though we assume that XP is a kind of peculiar sentences, sentences cannot be the complements of finite auxiliary verbs in English.

Another option is to adopt the word order domain approach introduced by Reape (1994, 1995). According to Reape, domain elements in daughters are put together in the mother's domain when daughters merge. Then, the order of domain elements in the mother node is determined not by the Immediate Dominance (ID) rules or the constituency, but by domain rules. One of the most important features in this approach is the UN(IONED) feature. The value of the UN feature is represented as binary notation, negative and positive. If a phrase α contains [UN -], domain elements in α are frozen like an inseparable cluster and do not allow other domain elements in the α 's sister to be inserted between domain elements in α . On the other hand, when a phrase β contains [UN +], domain elements in β can be shuffled with domain elements in the β 's sister.

In order to allow the word order of the sentence (16b), the domain structure should be represented as in (19).

(19)



(19) illustrates that the subject is preceded by auxiliary verbs in the domain of S, even though the subject precedes auxiliaries according to the head-subject ID rule. In order to produce a sentence with the proper word order, all auxiliary verbs in (19) should contain [INV+], since only elements with [INV+] can be followed by the subject. In addition, VPs whose head is the auxiliary verb with [INV+] must contain [UN+] in order not to make itself frozen, allowing auxiliary verbs and the subject to be shuffled.

This analysis also has a non-trivial objection. The word order of (19) is possible when a rule is assumed that the auxiliary verb with [INV+] should subcategorize for a certain complement. The complement should have [UN+] and its head must contain [INV+], when the head has [AUX+]. Otherwise, the subject could be located between auxiliary verbs, producing CI with the improper word order. However, if this rule is applied to all verbs with [INV+], we cannot properly rule out ungrammatical sentences. (20a) is an interrogative clause with the appropriate word order, while (20b) is ill-formed due to the position of the subject.

- (20) a. How might they have been produced?
 b. *How might have been they produced?

When the rule is applied to all auxiliary verbs containing [INV+] in (20), *have* - the head of the complement of *might* - should have [INV+] and its projection has to contain [UN+]. Besides, the complement VP of *have* should contain [UN+] and *been* must have [INV+]. And the subject is preceded by auxiliary verb with [INV+]. Then, (20a) cannot be produced, making (20b) grammatical unexpectedly.

Consequently, this analysis falls in a dilemma. If we make a rule that a finite auxiliary verb with [INV+] subcategorizes for a phrase whose head has [INV-], the word order of other inversions can be explained, while CI where

a cluster of auxiliary verbs precedes the subject cannot. On the other hand, if the rule for CI is applied to all verbs with [INV +], the proper word order of other inversions cannot be derived.

Until now, I have examined two possible options to explain the word order of CI. The phrase structure rule approach has a serious problem that it has to violate some existing phrase structure rules. Additionally, the word order domain approach does not have a device to rule out overgenerated sentences when the word order rule for CI is adopted. Thus, an interim conclusion can be drawn that CI cannot be analyzed with the existing phrase structure rule approach or the word order domain approach.

Now, I turn to the last option. This one takes advantage of both the construction-based approach and the word order domain approach. In the existing construction-based approach, the word order of English is determined by the constituency. In my analysis, however, the word order is determined by word order domain rules. That is to say, constraints on properties of lexemes participating in certain phrases are governed by the construction-based approach, while the word order of the phrases is determined by domain rules.

In this approach, one thing I assume is that the default value of the UN feature is negative in the absence of any additional constraint. This assumption prevents word order domain rules from producing sentences with the improper word order by means of shuffling.

When the constraints in charge of the word order is separated from construction-based approach and the word order is not determined by the constituency any more, all phrases need rules to obey which will allow every element in them to be located at the proper position. The first domain rule specifies the order between the head and the complement. In all phrases in English, the head is always followed by its complement. This basic rule can be represented as in (21).

- (21) Head-complement rule:

$$\text{DOM} \langle [\text{COMPS} \langle [\text{HEAD } \boxed{1}] \rangle] \rangle < \text{DOM} \langle [\text{HEAD } \boxed{1}] \rangle$$

(21) illustrates that a head should be followed by its complement's head in the domain. If this rule is not present, we cannot rule out the phrase where the complement precedes the head.

Another rule essential to explain the order of phrase elements has to do with the position of the subject. The position of the subject is pivotal to identify the clausal type. To illustrate, in most declarative clauses subjects are located before finite verbs. However, subjects are preceded by finite auxiliary verbs in interrogative clauses. The position of the subject depends on the value of the INV feature in verbs. A finite auxiliary verb in the declarative clause without the subject-auxiliary inversion has [INV -], while that in the

interrogative clause contains [INV +]. A rule which can capture this word order is described as in (22).

(22) Subject rule:

$$\left[\begin{array}{c} \text{INV} + \\ \text{SUBJ} \langle \boxed{2} \rangle \end{array} \right] < \boxed{2} < \left[\begin{array}{c} \text{INV} - \\ \text{SUBJ} \langle \boxed{2} \rangle \end{array} \right]$$

(22) implies that all auxiliary verbs with [INV +] must precede the subject and that those with [INV -] should follow the subject.

Given the word order domain rules above, a phrase type CI belongs to should be identified. This is related to explaining where constraints of the phrase type for CI inherit from, according to multiple inheritance hierarchy.

In the construction-based approach in English, non-finite auxiliary verbs have [INV -] by default in the absence of any constraint, which assures that the non-finite auxiliary verb in every English phrase type has [INV -]. This means that CI cannot be analyzed with existing types of phrases, since all non-finite auxiliary verbs in CI should have [INV +], given the fact that all auxiliary verbs preceding the subject cannot contain [INV -] in any kind of inversions, according to (22).

This translates into the need to devise a new phrase type that forces non-finite auxiliary verbs participating in CI to have [INV +]. In addition, the perspective phrase type must allow the subject to shuffle with elements in the auxiliary verb phrase. If the subject merges with the auxiliary verb phrase with [UN -], the subject cannot be located between more than one auxiliary verb and the non-auxiliary verb phrase.

The phrase type should also evince that a finite auxiliary verb must subcategorize for one of two kinds of complements – VP with [INV +] and [UN +] or a phrase with [AUX -]. The former allows the subject to be shuffled with elements in the auxiliary verb phrase when CI has more than one auxiliary verb, while the latter can capture the word order of CI that has only one finite auxiliary verb.

One question arises here is why the subject is preceded by more than one auxiliary verb in CI. I accept the suggestion by Culicover and Winkler (2008) and Gergel, Gengel, and Winkler (2007) that this inversion is caused by the information structure restriction that the inverted subject should be interpreted only as focus, especially contrastive focus. This is why Culicover and Winkler (2008) regard CI as a type of focus inversions. According to Gundel and Fretheim (2004), contrastive focus is a material that plays a role in calling to the hearer's attention and mentioning contrasts with other entities. In CI, the inverted subject contrasts with the subject in the main clause and, thus, it is emphasized enough to capture the hearer's attention.

Culicover and Winkler (2008) use the behavior of epithets to show that the inverted subject in CI is restricted to be interpreted as contrastive focus as follows.

- (23) a. Bill Clinton_i said more than the president_i could have.
 b. Bill Clinton_i said more than could have the president_j.
 c. Bill Clinton_i said more than the president_j could have.
 d. *Bill Clinton_i said more than could have the president_i.

(23a) indicates that a coreferential reading is possible because the subject in comparative clause is not interpreted as contrastive focus. The subjects without contrastive meaning can precede auxiliary verbs in comparative clauses. This shows that the canonical subject position is not the place only for contrastive focus. This implies that the information structure of subjects in canonical comparatives does not have to be restricted to contrastive focus. On the other hand, the contrast between (23b) and (23d) manifests that the subject only with contrastive focus meaning can be preceded by a cluster of auxiliary verbs in CI. Otherwise, the coreferential subject could be located at the sentence final position in (23d).

Gergel, Gengel and Winkler (2007) also examine that only elements with contrastive focus meaning can occupy the inverted subject position in CI with the pronominalization.

- (24) a. Manny_i plays the piano better than did HE_{*i/j}.
 b. He_i said he could play the piano better than did HE_{*i/j}.

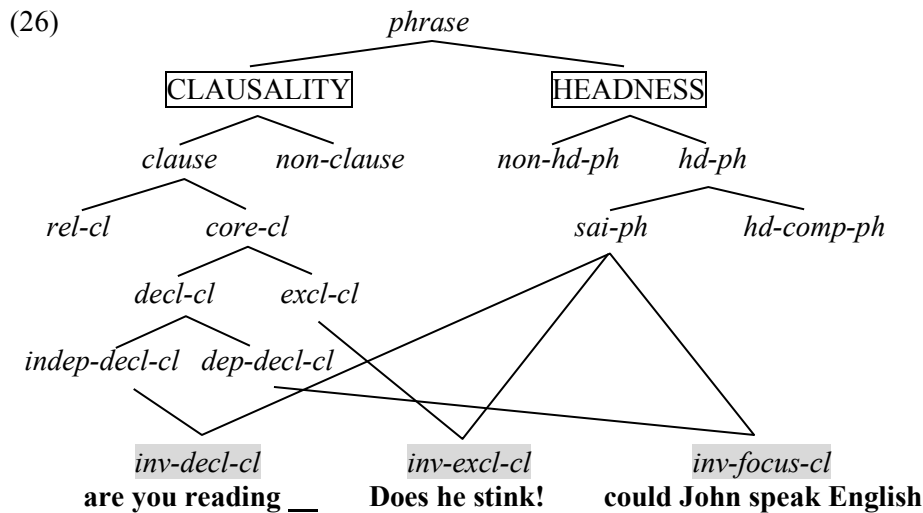
Sentences in (24) depict that the pronoun non-coreferential with the subject in the main sentence can follow the auxiliary verb, while the pronoun subject without contrastive focus meaning cannot undergo the subject-auxiliary inversion.

This delineates the close relationship between information structure and a specific phrase type because the subject in this phrase type should be interpreted only as focus. Thus, I propose that the information structure of the construction should be specified as a constraint of the phrase for CI. That is to say, the subject in CI contains the INFO-STRUC|FOC feature and its value is identical to that of the CONT feature, following the Engdahl (1999)'s approach. Of course, the information structure value is not specified in the lexical entry of the subject in other phrase types, since the information structure of elements in phrases is not guaranteed by the phrase type in general. However, I make this suggestion in order to emphasize that the phrase type for CI is caused by information structure and to make a distinction from phrase types related to other inversions.

All constraints for CI that should be taken into account are put together in a following new phrase type as in (25). I will name this *inv-focus-cl*.

$$(25) \textit{inv-focus-cl}: [\quad] \rightarrow H \left[\begin{array}{l} \text{SUBJ} \langle [\text{FOC } \boxed{\text{A}}] \rangle \\ \text{COMPS} \langle [\text{INV } +] \mid [\text{AUX } -] \rangle \end{array} \right], \dots$$

According to the construction-based approach, all phrase types are defined by two dimensions - CLAUSALITY and HEADNESS. In other words, constraints of a certain phrase should show its clause type and the relationship between the head daughter and the non-head daughters. Constraints of *inv-focus-cl* inherit from both *dep(endent)-decl(arative)-cl(ause)* and *inv(ersion)-ph(rase)*. This is because *inv-focus-cl* cannot stand alone, containing *austinian* semantic type, and the subject is preceded by a finite auxiliary verb. Thus, the location of *inv-focus-cl* in the phrasal type hierarchy can be sketched as in (26).



(26) shows that *inv-decl-cl* and *inv-focus-cl* have their own distinct status as a phrase type through the distinction between *dep-decl-cl* and *indep-decl-cl*.

When a comparative clause contains two auxiliary verbs, *inv-focus-cl* guarantees that the finite auxiliary verb subcategorizes for VP with [INV +] as the HEAD feature and [UN +]. This allows the subject to be located between the second auxiliary verb and the non-auxiliary verb phrase as follows.

- (27) a. John might have eaten cookies faster than might have Paul made.
 b. Mike wrote more books than would have John read.

Yet, *inv-focus-cl* is not sufficient, because this phrase type cannot control properties of the third auxiliary verb when a cluster of auxiliaries consists of three auxiliary verbs. This means that *inv-focus-cl* cannot force

the third auxiliary verb to have [INV +], because all non-finite auxiliary verbs have [INV -] by default. Then, *inv-focus-cl* cannot guarantee the word order of (2b) and (16c) (They are repeated here as (28a) and (28b), respectively).

- (28) a. To her, thinking, as she ever was thinking, about Johnny Eames, Siph was much more agreeable than might have been a younger man.
 b. ?Mary would have been angry much longer than would have been John, happy.

In order to capture the word order of CI that cannot be covered by constraints in *inv-focus-cl*, an additional rule is necessary. The prospective rule must be able to guarantee that the complement of the second auxiliary verb should satisfy following condition: Either VP whose head is the auxiliary verb should contain [UN +] and its head should have [INV +] or a phrase must have [AUX -]. This constraint is represented as in (29).

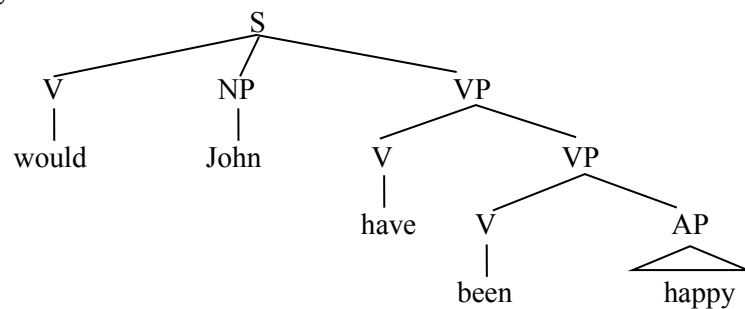
(29) [INV +] verb rule

When a non-finite verb with [INV +] subcategorizes for an auxiliary verb phrase, the phrase has [UN+] and its HEAD feature contains [INV +].

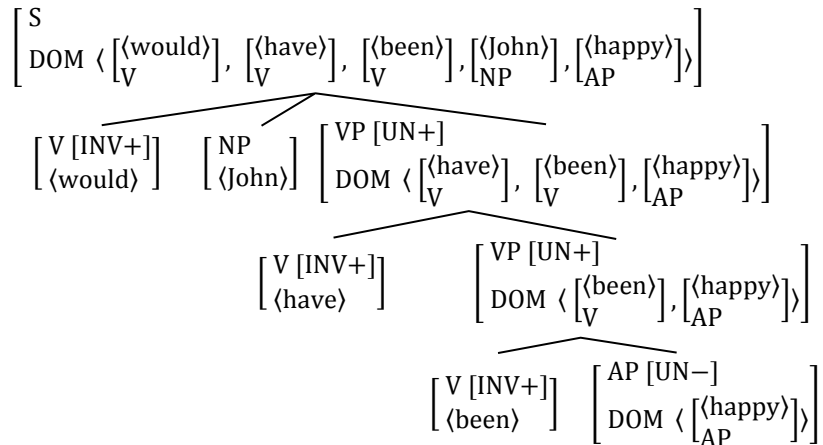
This rule implies that non-finite auxiliary verbs can have either [INV +] or [INV -]. Nonetheless, all non-finite auxiliaries in CI can have [INV +] through (29). This is possible because *inv-focus-cl* guarantees that the second auxiliary verb should contain [INV +] and then the [INV +] verb rule is applied to all non-finite auxiliary verbs in CI.

When constraints that have been mentioned so far are integrated, the syntactic tree and the word order tree for (28b) can be represented as in (30a) and (30b), respectively.

(30) a. Syntax tree



b. Word order tree



It is natural to have this discrepancy between the syntax tree and the word order tree. This is because syntactic properties of CI except the word order come from constraints adopted by the construction-based approach, while the word order of this inversion is determined by the word order domain rules.

In (30b), the domain order of the lowest VP is determined by the head-complement rule, so *been* precedes *happy*. When *have* combines with VP containing [UN +], the head-complement rule is also applied and *have* is followed by *been* as a result. At last, the domain elements in S are arranged by the subject rule as well as the head-complement rule. Then, *could* precedes *have* and the subject is located between *been* and *happy*.

This approach seems to be rather more complex than other analyses, since this adopts two very strong approaches. However, this analysis is superior to previous analyses due to the following reasons. Unlike the word order domain approach, this approach can stop sentences with the improper word order from being produced. To be specific, *inv-focus-cl* specifies that the complement of the finite auxiliary verb should have [INV +] when its head – the second auxiliary – contains [AUX +] and this causes the third auxiliary with [INV +] to be followed by the subject. Since any phrase type participating in producing interrogative inversion does not specify the constraint that the finite auxiliary verb should take VP whose head has [INV +], the non-finite auxiliary verbs in interrogatives contain [INV –] by default.

This approach can also account for the optional ellipsis of auxiliary verb phrases. In my analysis, all auxiliary verbs can delete their complements before combining with the subject. Thus, the inverted subject can be present in CI with auxiliary VP ellipsis without any specific rule. This avoids the crucial problem Culicover and Winkler (2008) encounter.

4. Implication

In the previous chapter, I conclude that a cluster of auxiliary verbs can be followed by the subject in CI when the subject is interpreted as focus and the word order of this construction is licensed by *inv-focus-cl* and related word order rules. This conclusion makes us to predict that other inversion constructions which are under the same conditions CI has can have the word order identical to that of CI. This follows that those inversions can be subtypes of *inv-focus-cl*. The following constructions show how this prediction is borne out.

4.1. *nor*-inversion

In (31), only a finite auxiliary verb precedes the subject in *nor*-clauses, leaving its following auxiliary verbs in the original position.

- (31) a. Our man from Pernambuco had no inkling of this treachery, nor
would he have given it his approval. (COCA)
b. Edict 1 had been passed so long ago that most citizens of Spyre did
not even know it existed, nor would they have understood its
significance if it were described to them. (COCA)

Examples in (31) do not pattern with CI this paper focuses on in that the subjects are located between auxiliary verbs. This is not surprising since the subjects in sentences in (31) are co-referential with their antecedents in the main sentences and they can never be interpreted as focus. In (32), however, the subjects with focus meaning in *nor*-inversion are preceded by a cluster of auxiliary verbs. This means that examples in (32) cannot be analyzed with the phrase type for the inversion in (31). The examples come from American and British English corpora and the Internet.

- (32) a. A minor brawl between Arabs and Jews would have been nothing, nor
would have been Israeli Arab demonstrators clashing with police in
Arab townships, or Jewish settlers and Palestinians attacking each
other's persons and property in the occupied territories. (COCA)
b. This harassment used the mechanisms provided by the research ethics
industry on campus, and it seems likely that a private therapist would
not have been such an easy target, nor would have a journalist. (BNC)
c. I haven't been surprised by the rally, nor should have been my readers.
d. As for the balancing of the flywheel to the driven plate, my friend
wasn't familiar with that, nor might have been the guy who did the
conversion originally.
e. ?I have not seen Sobers play nor might have Harsha watched him in
his pomp.

- f. He did not die on the cross, nor could have any man died on the cross in such a short period.

The subject can be located between a cluster of auxiliaries and the non-auxiliary verb phrase in (32e,f) just like CI, as I predicted. In order to account for this inversion, *inv-focus-cl*, word order domain rules and the [INV+] verb rule are also needed.

4.2. *as*-inversion and *so*-inversion

As Culicover and Winkler (2008) mention, *as*-inversion, *so*-inversion, and CI show the similar word order.

- (33) a. Blair fell down the stairs, as did her brother.
b. John made his hair cut, and so did Tom.

At a cursory glance, sentences in (33) indicate that *as*-inversion and *so*-inversion can be analyzed with existing phrase types for inversions. However, it can be found that *inv-focus-cl* and related rules are essential to capture the word order of those two inversions in the sense that they also allow the auxiliary cluster inversion as in (34).

- (34) a. As the pyramid rose, the working space would have diminished, of course, and so would have the number of teams that could simultaneously work atop it
b. Jane had been there, and so had been her boy friend.
c. Sandy would have been very angry, as would have been all of the people who invested in the project. (Culicover and Winkler, 2008)

Sentences in (34) illustrate that each inverted subject has only focus meaning and it is preceded by a cluster of auxiliary verbs. Even though the non-auxiliary verb phrases do not follow the inverted subjects in *as*-inversions and *so*-inversions as in CI, the word order of two inversions also can be explained with *inv-focus-cl* and related rules.

Thus, from the examples above, a conclusion can be drawn that the inversion construction that *inv-focus-cl* and word order rules can cover is not confined to CI. Rather, they can be applied to *nor*-inversion, *as*-inversion, and *so*-inversion, even though syntactic properties of these inversions are not identical to those of CI.

5. Conclusion

This paper was motivated by the observation that existing syntactic analyses – T-to-C movement, the suspension of an EPP and *v2-decl-cl* – cannot

account for the puzzling phenomenon that a cluster of auxiliary verbs can be followed by the subject in CI.

I proposed that CI should be explained by the combination of both the word order domain approach and the construction-based approach, since the word order of CI does not follow the constituency. Based on this proposal, I introduced a new type of phrase, called *inv-focus-cl*. This new phrase has the following constraints: 1) the inverted subject should have the FOC value and 2) the head of this phrase subcategorizes for the complement which contains either [INV +] as the HEAD value and [UN +] or [AUX –]. In order to explain the word order of CI with three auxiliary verbs, the [INV +] verb rule was suggested. I also provided an implication that constraints for CI can be applied to other kinds of inversions – *nor*-inversion, *as*-inversion, and *so*-inversion – where the inverted subject is restricted to have the focus interpretation.

Given the new suggestions above, this paper makes some contributions toward HPSG as follows. First of all, *inv-focus-cl* and related rules can correctly account for the word order of CI which existing analyses fail to capture. The fact that these constraints can also explain the optional auxiliary VP ellipsis in CI is of great significance. In addition, this paper suggests a uniform way to explain the word order of focus inversions including CI, *nor*-inversion, *as*-inversion, and *so*-inversion within the framework of HPSG. At last, this analysis provides the necessity to adopt the word order domain approach within the construction-based approach in English. This lays the foundation for scrutinizing other possible constructions with discontinuous constituency.

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