The Weight Effect as a PF-interface Phenomenon[*]

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Abstract
The weight effect in English Heavy Noun Phrase Shift (HNPS) is relative and prosodic in nature. Based on this observation, this paper proposes a measure of weight which predicts that an HNPS sentence is acceptable when the sentence-final NP contains more prosodic words than the element shifted over by the NP. This proposal is based on the assumption that the weight effect is a processing-motivated phenomenon (Hawkins 1994).

Keywords:
Heavy NP Shift, prosodic word, relative weight, processing

1. Introduction

The aim of this paper is to formalize the notion of "weight". In English, there is a tendency that a heavy element appears in sentence-final position. Heavy Noun Phrase Shift (HNPS), which is exemplified by (1b), is one of the linguistic constructions which exhibit the "end-weight" effect.

(1) a. He threw [the letter from the principle decoder] into the wastebasket.

 b. He threw into the wastebasket [the letter from the principle decoder].

(2) a. He threw [the letters] into the wastebasket.

 b. *He threw into the wastebasket [the letters].   (Zec and Inkelas 1990:376)

Canonically, verbs take an NP and a PP in V-NP-PP order and the verb *throw* is no exception to this. In (1) and (2), the (a) sentences show the canonical V-NP-PP order, and the (b) sentences show an alternative V-PP-NP order. The characteristic property of the alternation between (a) and (b) is that an NP must be of some minimal size in order to be in sentence-final position, departing from the canonical order. The NP *the letter ... decoder* in (1) is heavy enough to achieve end-weight of the sentence, whereas the NP *the letters* is not. But how heavy should an NP be precisely? My claim in this paper is that (i) the weight effect in HNPS, or rearrangements in general, should be captured by a *prosodic* condition and (ii) the weight should be assessed in *relative* terms.

The contrast in (3), originally pointed out by Inkelas (1989), provides a strong argument that HNPS is constrained prosodically:[1]

(3) a. Mary gave to Sue [that report on Dukakis].
    b. ??Mary gave to Sue [that report on him].   (Inkelas 1989:17-18)

The observable difference between (3a) and (3b) is in whether the shifted NP contains a proper name or a pronoun, which is closely related to the difference of their prosodic property. A proper name carries a lexical stress and is regarded as an independent prosodic word, whereas a monosyllabic pronoun is stressless in an unmarked case and does not construct a prosodic word on its own. With the prosodic measure of weight, we can say that the HNPS sentence in (3a) is better than that in (3b) because the shifted NP of (3a) is heavier than that of (3b) by one prosodic word, conforming to end-weight more effectively.

The contrast in (4) shows that looking at the absolute weight of a shifted NP is not enough to predict the acceptability of an HNPS sentence (see Hawkins 1990,1994, Wasow 1997, Tokizaki 2000, Shiobara 2000a,2001 for the relative weight effect):

(4) a. ?He showed to John [some letters from Paris].
    b. ?*He showed to the man who was sitting next to him [some letters from Paris].

The sentences in (4) have the same shifted NP. The less acceptable sentence in (4b) has a heavier intervening PP, which gives rise to the relative lightness of the shifted NP.

Faced with these two properties of the weight effect, I would like to propose a condition

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[1] The acceptability of sentences in this paper comes from judgments by native speakers I consulted unless otherwise noted. The criteria of acceptability is: no mark or "√" = completely acceptable, "?" = not quite fully acceptable, "??" = relatively unacceptable, "?*" = only barely acceptable, and "*" = completely unacceptable (cf. Ross 1986:24). And "?-*", for example, means that the judgments of the sentence vary between ? and * among speakers.

on HNPS which compares the number of prosodic words of a shifted NP and an element intervening between the verb and the shifted NP (Shiobara 2000a,2001, Selkirk 2001). This correctly predicts that when the number increases toward the end of the sentence, the HNPS is acceptable, and the more radical the increase is, the better the sentence is. This increasing weight effect is likely to be grounded in processing principles such as Hawkins' (1990,1994) principle of Early Immediate Constituents (EIC). The EIC is essentially a memory-motivated principle, according to which the human parser prefers minimizing the time elapsed between the constituents of the first immediate constituent (IC, e.g. a verb in this case) and the last IC (e.g. NP in the V-PP-NP order) of a mother node (e.g. VP). The weight effect, which is measured by prosodic words and grounded in a processing principle, is regarded as a PF-interface phenomenon (cf. Chomsky 1995).

The paper is organized as follows. Section 2 looks at the end-weight effect in English and shows that the effect is prosodic in nature. Section 3 critically reviews previous studies on weight effect: Zec and Inkelas' (1990) prosodic approach, and Hawkins' (1994) processing approach. The weakness of the prosodic approach is that it only looks at the absolute weight of an NP, not the relative weight of it. On the other hand, Hawkins' approach has difficulty in accounting for the contrast in (3) we saw above because it counts syntactic words, not prosodic words. In section 4, I propose a prosodic measure of the relative weight and show how it makes correct predictions regarding the contrast in (3), (4), and other examples. The theoretical status of the proposal is also discussed. Section 5 provides a broader perspective of the prosodic weight effect, namely a cross-linguistic perspective and its interaction with LF side of interface conditions.

2. The Weight Effect in English Heavy NP Shift

2.1. Data

It has been noted in descriptive grammar (Quirk et al. 1972,1985) that English tends to place a "heavy" constituent in sentence-final position.

(5) ... the tendency to reserve the final position for the more complex parts of a clause or
    sentence...   (Quirk et al. 1972:943)
(6) ... to achieve a stylistically well-balanced sentence in accordance with the norms of
    English structure; in particular to achieve END-WEIGHT.   (Quirk et al. 1985:1398)

The following examples exhibit the end-weight effect. The sentences in (7) and (8) are from written texts and (9) is from speech:

(7) a. We exclude from consideration [candidates with epenthetic syllables and those with multiple prosodic words dividing up a single morphological word].

(from McCarthy and Prince 1993:11)

b. We exclude [candidates with epenthetic syllables and those with multiple prosodic words dividing up a single morphological word]from consideration.

(8) a. This paper renders superfluous [the intuitive motivation for pied-piping proposed in MP]...

(from Chomsky 1998:147, note74)

b. This paper renders [the intuitive motivation for pied-piping proposed in MP...] superfluous.

(9) a. You'll find in your seat pocket [a copy of *Hemispheres*].

(United Airlines flight attendant, cited from Wasow 1997:83)

b. You'll find [a copy of *Hemispheres*] in your seat pocket.

In (7)-(9) two orderings of postverbal constituents, (a) Verb (V) – XP – NP and (b) V – NP – XP, are possible and the (a) sentences are the actually observed ones. In (a) a heavy constituent, namely a noun phrase, is placed in sentence-final position and this construction or the operation which generates this construction, called Heavy Noun Phrase Shift (HNPS, cf. Ross 1986), occurs only when the object NP is heavy in some sense. Let us look at more examples to see how heavy an NP should be in order to appear in sentence-final position.

First, the number of syntactic words or syntactic complexity seems to be relevant:

(10)   Q: What did Max show to Sue?
       A:
           a. ??-*He showed to her [some letters].
           b. ?He showed to her [[some letters] [from Paris]].
           c. He showed to her [[some letters] [from his favorite city]].
           d. He showed to her [[[his mother's] friend's] father].

The shifted NP in (10a) is syntactically less heavy than those in (10b-c) in that the NP does not contain a PP modifier. The number of syntactic words in a shifted NP, that is to say 2 in (10a), 4 in (10b), and 6 in (10c), can explain the gradient difference in acceptability: the more syntactic words the shifted NP contains, the heavier the NP is and the more acceptable the whole sentence is. The acceptability of (10d) shows that a prenominal modifier also contributes to the heaviness.

However, the syntactic measure of weight is incomplete. As Inkelas (1989:17-18) points out, it faces a difficulty in describing the contrast in (11):

(11)   a. Mary gave to Sue [that report on Dukakis].

b. ??Mary gave to Sue [that report on him].

In her paper, there is no preceding context provided for (11). The difference between (11a) and (11b) is in whether the shifted NP contains a proper name or a pronoun. We cannot maintain a syntactic approach to HNPS without an additional stipulation that proper names and pronouns are assigned different syntactic categories or structures. Inkelas describes the contrast in prosodic terms: the NP in (11a) consists of two phonological phrases whereas that in (11b) consists of only one because the pronoun is prosodically weak and does not contribute to construct a prosodic word, or a phonological phrase. Interestingly, the NP in (11b) becomes heavier when the pronoun achieves prosodic prominence in an appropriate context and becomes prosodically strong (cf. Shiobara 2000a, 2001):

(12) Q: What did John give to Sue?

A:

a. ?He gave to her [the report on Jim].   (NB: √ without the preposition *to*. cf. Note5)

b. He gave to her [the report on HIM].

(pointing at Jim who is in front of the speaker)

(NB: Upper case letters mean that the pronoun carries prosodic prominence, namely a pitch accent.)

c. *He gave to her [the report on him].

Given that a proper name and a strong pronoun pattern together whereas a weak pronoun does not, it is hard to account for this contrast in syntactic terms. Note that the same contrast is observed with the first person pronoun *me* which is inherently deictic:

(13) Q: What did John give to Sue?

A:

a. He gave to her [the report on ME].

b. ?-*He gave to her [the report on me].

(NB: (13b) is relatively acceptable if the noun *report* carries prosodic prominence)

This suggests that the contrast between a pronoun with prosodic prominence and a pronoun without one is prosodic in nature, not pragmatic.

Next let us see whether the levels below prosodic words, i.e. feet and syllables, are relevant to the weight effect.

(14) Q: What did John give to Sue?   the foot structure of
     A: proper name

    a. ?He gave to her [the report on Elízabèth]. $\sigma(\acute\sigma\ \sigma)_{Ft}(\grave\sigma)_{Ft}$

    b. ?He gave to her [the report on Àlexánder]. $(\grave\sigma\ \sigma)(\acute\sigma\ \sigma)$

    c. ?He gave to her [the report on Dukákis]. $\sigma\ (\acute\sigma\ \sigma)$

    d. ?He gave to her [the report on Álex]. $(\acute\sigma\ \sigma)$

    e. ?He gave to her [the report on Jím]. $(\acute\sigma)$

    f. ?He gave to her [the report on Álex Wílson]. $(\acute\sigma\ \sigma)\ (\acute\sigma\ \sigma)$

                      (NB: All sentences are √ without the preposition *to*.)

(15) Q: What did John buy for Sue?
     A: preposition

    a. He bought for her [a house úndernèath the trees]. $(\acute\sigma\ \sigma)(\grave\sigma)$

    b. He bought for her [a house únder the trees]. $(\acute\sigma\ \sigma)$

    c. He bought for her [a house in the trees]. σ

In (14), the number of syllables and/or the foot structure of proper names are controlled, and in (15) those of prepositions are controlled. If the weight of a shifted NP is determined by the number of feet, it is predicted that (14a), (14b) and (14f) are better than (14c), (14d), and (14e); and (15a) is better than (15b), and (15b) in turn is better than (15c). If the weight is determined in terms of the number of syllables, (14a), (14b) and (14f) would be better than (14c), (14c) would be better than (14d), and (14d) would be better than (14e); and (15a) would be better than (15b), and (15b) would be better than (15c). However, all sentences are judged to be equal.[2][3] The slight degrading in (14) sentences comes from English speakers' preference of sentences without the preposition *to* (e.g. he gave her [the report on ---]). A proper name and the abbreviation of it do not make a difference in acceptability either:

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[2]   McDonald et al. (1993) present experimental data that shows the irrelevance of the number of syllables to word order in language production. See also Cohan (2001) for experiments that suggest the irrelevance of syllable numbers in Dutch HNPS.

[3]   Heavy PP Shift like the following does not exhibit any difference in acceptability either:

(i) Q: Where did John go with Sue when it started raining?
    A:
    a. He went with her [underneath the trees].
    b. He went with her [under the trees].
    c. He went with her [in the trees].
    d. He went with her [to the trees].

The verb *go* is more related to the place PP than to *with* PP semantically and syntactically, and the place PPs are considered to be shifted into sentence-final position.

(16) Q: What did John give to Sue?
    A:
        a. He gave to her [the report on the United Nations].
        b. He gave to her [the report on the UN].

The effect of syllable number seems to emerge when the number difference is more radical (cf. Fiengo 1974, Pullum and Zwicky 1988, Akasaka and Tateishi 2000):

(17) a. ?*I looked up in the dictionary [*coif*].
    b. ?*-*I looked up in the dictionary [*tsetse*].
    c. ?-??I looked up in the dictionary [*elephantiasis*].
    d. ?-??I looked up in the dictionary [*antidisestablishmenterianism*].
    e. √-?I looked up in the dictionary [*pneumonoultramicroscopicsilicavolcanocaniosis*].

On the surface, a word with more syllables makes the HNPS sentence more acceptable, though the prosodic structure of each word in (17) is yet to be examined in detail. Moreover, excessively long words naturally carry along semantic novelty and therefore it is too soon to conclude that the acceptability difference in (17) results from the prosodic weight of sentence-final NPs only.

Putting analyses aside, we need to accept that there is still another case in which the number of syllables appears to play a role in measuring the weight:

(18) Q: What did John show to Sue?

		adjective
A:		
a. ??He showed to her [a big dog].		(σ́)
b. √-??He showed to her [a vermilion dog].		σ(σ́σ)
c. ?-??He showed to her [a pink dog].		(σ́)
d. ?He showed to her [an Arabian dog].		σ(σ́σ)

The slight differences in acceptability in sentences in (18) tell us the following: an NP containing an adjective with more syllables is better to be in sentence-final position than an NP containing an adjective with less syllables: (b) and (d) can be better than (a) and (c) overall. Importantly, the NPs in (b) and (c) are equally anomalous semantically but still (b) is better than (c), which suggests the relevance of syllable numbers or words' frequency. That is, (b) is better than (c) either because the adjective *vermilion* has more syllables than *pink*, or because it is used less frequently than *pink*. And the heavier (d) is better than semantically anomalous (c), which suggests that the weight effect is more important than the semantic

effect in determining whether an NP can appear in sentence-final position or not. The differences in acceptability in (18) are very subtle if any and more extensive research is required on this.

Another important property of the weight effect is that the weight should be assessed in relative terms (cf. Hawkins 1990,1994, Wasow 1997, Tokizaki 2000, Shiobara 2000a,2001):

(19) Q: What did Max show?
    A:
        a. ?He showed to John [some letters from Paris].
        b. ?*He showed to the man who was sitting next to him [some letters from Paris].
        c. He showed [some letters from Paris] to John.
        d. He showed [some letters from Paris] to the man who was sitting next to him.

(20) Q: What did Max give to Sue and when?
    A:
        a. ??He gave to her yesterday morning [the report on Elizabeth].
        b.*He gave to her at the teachers' meeting yesterday morning [the report on Elizabeth].
        c. ?He gave to her [the report on Elizabeth] yesterday morning.
        d. ?He gave to her [the report on Elizabeth] at the teachers' meeting yesterday morning.
        (NB: (20c) and (20d) are relatively acceptable when the adverbial is focused.)

The sentences in (19a) and (19b) contain the same shifted NP, and so do the sentences in (20a) and (20b). The (b) sentences are worse than the respective (a) sentences. Notice that the acceptability of (19c) and (19d) shows that providing additional information regarding to whom Max showed the letters is not the source of unacceptability. Also, the acceptability of (20c) and (20d) shows that the presence of two foci in sentence-final position is not the source of unacceptability. Thus the shifted NP should be heavy, relative to the weight of the element that intervenes between the verb and the NP, such as a PP or an adverbial phrase. The following contrast indicates the relative weight effect should be assessed in prosodic terms too:

(21) Q: Who did Mary introduce at Jim's place?
    A:
        a. ??She introduced to Jim [a visitor from Afghanistan].
        b. ?She introduced to me [a visitor from Afghanistan].

Although the difference is subtle if any, the sentence in (21a) is less acceptable with the intervening PP containing a proper name than that in (21b) with the PP containing a pronoun.

The relative weight effect is more delicate than has been noted in the literature and is not found in every speaker's acceptability judgments. However, the corpus analyzed by Hawkins (1994:182-187) shows this effect clearly: HNPS order (i.e. V – PP – NP) is observed when NP is heavier than PP in terms of the number of syntactic words. Below is the summary of his data.

(22)　English Heavy NP Shift　(cf. Hawkins 1994:183, Table 4.22)
　　　　V-NP-PP order = 458
　　　　V-PP-NP order = 22

n = 131	NP = PP	NP > PP :by 1 word	:2	:3	:4	:5+
(i) V-NP-PP	68	25	13	4	2	0
(ii) V-PP-NP	0	0	2	3	5	9
rearrangement to (ii)	0%	0%	23%	43%	71%	100%

n = 349	PP > NP :by 1-2 words	:3-7	:8+
(iii) V-NP-PP	209	103	34
(iv) V-PP-NP	2	1	0

I assume, along with Hawkins and others (e.g. Love and Swinney 1998, Stallings et al. 1998), that the notion of basic order, which is V – NP – PP in this case, is linguistically significant for two reasons. First, this data shows that the order NP-PP is significantly more frequent than the reverse (458 vs 22) in English Verb Phrases (VPs). Secondly the order NP-PP is still productively maintained even when NP is heavier than PP by up to 4 words, and the PP-NP order requires a relatively heavy NP in order to depart from the NP-PP order.[4] The table in (22) shows that the heavier an NP is than a PP, the more the PP-NP order is chosen. Before moving on to the survey of previous analyses of the end-weight effect, let me give a brief note on another sentence-final property: the end-focus effect.

2.2.　A Note on End-Focus

In some literature, HNPS is regarded as focus-related displacement (e.g. Rochemont 1986, Rochemont and Culicover 1990). Quirk et al. (1985) describe the dual effects of the displacement in the following way: one is end-weight we saw in 2.1, and the other is what is

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[4]　See Takano (1998) for an argument for the opposite position that the HNPS order is basic. His argument is based on the antisymmetric theory of phrase structure and linear order (Kayne 1994), and hence purely theory-driven.

called end-focus:

(23) a. ... to achieve a stylistically well-balanced sentence in accordance with the norms of
English structure; in particular to achieve END-WEIGHT.   (= (6))
   b. ... to achieve an information climax with END-FOCUS.   (Quirk et al. 1985:1398)

The relationship between end-weight and end-focus is a very interesting issue to pursue and is beyond the scope of this paper. For present purposes, let me just note that end-weight should be distinguished from end-focus and there are cases where the former overrides the latter (cf. Hawkins 1994:ch.4.4).

As is usually assumed, the normal, non-contrastive focus of a sentence is taken to be reliably identified by what can be the answer to a question. In (24) the focus is on the person who is given the report by Mary:

(24) Q: Who did Mary give a report on Dukakis to?
   A:
      a. V – NP$_{[heavy]}$ – PP $_{[focus]}$
         ?*She gave [the report on Dukakis which was completed by PTA members several
         days ago] to Sue/SUE.
      b. V – PP$_{[focus]}$ – NP$_{[heavy]}$
         She gave to   ?Sue/SUE [the report on Dukakis which was completed by PTA
         members several days ago].

The unacceptable sentence in (24a) exhibits the basic V-NP-PP order, and NP is relatively heavier than PP. This sentence conforms to end-focus but not to end-weight. The acceptable sentence in (24b) exhibits the derived HNPS order, conforming to end-weight, but not to end-focus. The acceptability contrast between (24a) and (24b) indicates that the end-weight effect overrides the end-focus effect even though it results in departure from the basic order.[5] In other words, end-focus is not a necessary or sufficient condition for HNPS.[6] Note that

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[5]   The verb *give* can also subcategorize two NPs (e.g. She gave [Sue] [the report on Dukakis].) It is well known that the second NP should not be a pronoun:
(i) *She gave Sue it.
Because this sentence is unacceptable in any context, it is plausible to say that (i) is ruled out by not conforming to end-weight. End-focus is irrelevant to the unacceptability of (i). Hence this is another case where end-weight, but not end-focus, plays a role.
[6]   Williams (2000) argues that examples such as (20b) can be used metalinguistically under a very specialized use. He presents the following example:
(i) A: John gave to Joe all the money in the SATCHEL.
      B: No, John gave to MARY all the money in the satchel.
(iB) is used to correct (iA). In any case, an NP without a focus can be in sentence-final position.

giving additional information about the report is not the source of unacceptability of (24a) because (24b) is acceptable with the same NP. The sentence in (24a) improves with a special intonation contour (Bryan Gick, p.c.):

(25) Q: Who did Mary give a report on Dukakis to?
    A: She gave [the report on Dukakis, which,   I might add/ I'll have you know/ by the way, was completed by PTA members several days ago], to Sue.

In the acceptable sentence in (25A), the intervening NP contains even more words than that in the unacceptable sentence in (24a). In (25A) the relative clause, *which ... ago,* forms an independent intonational phrase and is prosodically weak like a parenthetical expression. Thus it seems that prosodically weak elements are ignored in measuring the weight whatever the exact definition of weight is.

    To sum up, end-focus is neither a necessary condition nor a sufficient condition on HNPS. The rest of this paper mainly analyzes the end-weight effect, and the end-focus effect will be briefly revisited in 5.2.

3.   A Critical Review of Previous Studies on the Weight Effect

3.1.   Prosodic Weight: Zec and Inkelas (1990)

    Zec and Inkelas (1990, Z&I) hypothesize the generalization in (26) regarding the weight effect in English Heavy NP Shift (HNPS):

(26) ... the dislocated NP is licensed when it contains at least two phonological phrases (Φ), that is, it consists of a branching Intonational Phrase (IP). (cf. Zec and Inkelas 1990:377)

This condition presumes the presence of prosodic-structure in the phonological component which has its own hierarchy of prosodic categories:

(27)   Prosodic Hierarchy   (cf. Selkirk 1986)
            utterance (U)
            intonational phrase (IP)
            phonological phrase (Φ)
            prosodic word (PWd)
        (foot (Ft)   )
        (syllable (σ)   )

The condition in (26) seems to describe the difference of acceptability in (28) relatively correctly, though not precisely.

(28) Q: What did Max show to Sue?

    A

        a. ??-*He showed to her [[some letters]Φ]IP.

        b. ?He showed to her [[some letters]Φ [from Paris]Φ]IP.

        c. He showed to her [[some letters]Φ [from his beloved city]Φ]IP. (cf. Z&I 1990:377)

The sentence in (28a) is ruled out by (26) because the shifted NP is made up of one phonological phrase and hence not licensed whereas the sentences in (28b) and (28c) are ruled in because the shifted NPs consist of two phonological phrases. Furthermore, it potentially predicts the interesting contrast in (29) which we saw in 2.1:

(29) a. Mary gave to Sue [[that report]Φ [on Dukakis]Φ]IP.

    b. ??Mary gave to Sue [[that report on him]Φ]IP.   (Inkelas 1989:17-18)

Z&I say that unemphasized object pronouns such as *him* in (29b) are always enclitics in English and they do not constitute phonological words on their own. Accordingly, the shifted NP in (29a) consists of two phonological phrases and the sentence is acceptable whereas the shifted NP in (29b) consists of one phonological phrase and it is ruled out by (26).

    There are at least three problems with the prosodic condition in (26) proposed by Z&I. First, they do not make clear assumptions about the prosodic structure in English. In (29b), for example, it is not clear why or how the assumption that a weak pronoun does not construct a prosodic word is related to the assumption that the whole shifted NP consists of one phonological phrase. In the next section, I will look at the prosodic structure in English in more detail, particularly the level of prosodic words, and consider also how the prosodic structure is related to the syntactic structure.

    Secondly, the condition in (26) refers to the absolute weight of a shifted NP and hence cannot account for the increasing weight effect in HNPS sentences. For example, it rules in (30a) and (30b) equally because both sentences have the same shifted NP which consists of two phonological phrases.

(30) Q: What did Max show?

   A:

      a. ?He showed to John [[some letters]Φ [from Paris]Φ].

      b. ?*He showed to the man who was sitting next to him [[some letters]Φ [from Paris]Φ].

Another problem, which is both theoretical and empirical, is that the condition in (26) is specific to NP shift and inapplicable to other constructions. It is an empirical problem as well because another linguistic construction in English, Extraposition from NP, actually exhibits the similar kind of degrading pattern as HNPS:

(31) Extraposition from NP

   Q: By whom did a book come out yesterday?

   A:

      a. √-??A book came out [by Irene Heim].

      b. A book came out [by HER/*her].   (pointing at Irene Heim in front of the speaker)

      c. A book came out [by ME/*me].

In (31) the PP *by*... , modifying the noun *book*, is focused and extraposed into sentence-final position. The degree of acceptability in (31) is clearly related to the content of an extraposed phrase and a condition which could capture degradation patterns in both HNPS and Extraposition from NP is theoretically more welcome than the NP shift-specific condition in (26).[7]

3.2. Syntactic Weight: Hawkins' (1994) Processing Principle

In the course of criticizing Z&I's prosodic approach to the weight effect, we saw that Extraposition from NP (EXNP) construction shows the similar degrading pattern as HNPS. The property characteristic of the HNPS and EXNP constructions is that a phrase appears in sentence-final position that is not the base/canonical position for the phrase. It is reasonable to consider that these constructions are motivated by processing considerations which favor a well-balanced sentence by achieving an end-weight (Quirk et al. 1972,1985, see section 2.1). The syntactic processing (i.e. parsing) concerns how sequentially perceived words are

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[7] Safir (1985:125) points out the weight effect in the Presentational There Insertion construction too:

(i) a. *There walked into the room [John].

     b. ?There walked into the room [the Princess of Cleves].

   c. There walked into the room [the man who everyone thought would one day rule the world].

grouped into constituents hierarchically. This grouping is done with quite remarkable speed and efficiency. Hawkins (1990,1994,2001) explains this rapidity and efficiency of on-line processing by two fundamental proposals: first he notices that there are some syntactic categories that are unique to their respective dominating mother nodes and that can act as signals to the parser to construct the relevant mother node. For example, function words such as D(eterminer) and Comp(lementizer) construct NP (or DP) and S' (or CP) respectively, and heads uniquely construct phrases (e.g. N is unique to NP, V is unique to VP etc.)

Second, and the main argument of Hawkins (1990), which is relevant to the current discussion of HNPS and EXNP, is that the rapidity of processing depends on the order of words. He proposes the processing principle of Early Immediate Constituents (EIC) that makes the following prediction: if a grammar encodes a rearrangement rule in response to EIC (for example, HNPS), the rule will apply only to those grammatical categories and only in that (leftward or rightward) direction that will potentially make the recognition of relevant constituents earlier (cf. Hawkins 1990:246).[8] In HNPS cases, for example, a VP that consists of V, NP and PP (or XP in more general) is the relevant constituent.
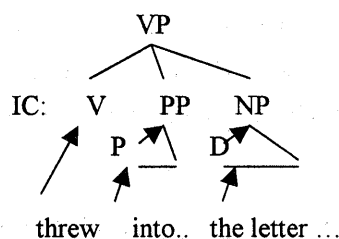
(32)   a. He threw [the letter from the principle decoder] into the wastebasket.
       b. He threw into the wastebasket [the letter from the principle decoder].
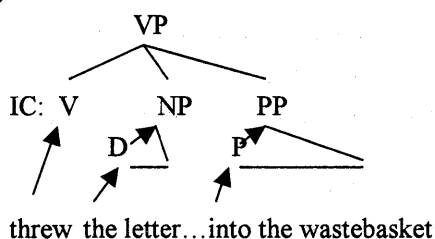
(33)   a. Basic order   b. HNPS order

In (32a), the parser needs to process 8 words (underlined in (33a)), from the verb *threw* to the preposition *into* that signals the last immediate constituent (IC) of VP, to recognize what the VP consists of, whereas in (32b) the parser needs to process only 5 words (underlined in (33b)), from the verb to the determiner *the* that signals the last IC of VP, which is NP (or DP). The principle EIC predicts that the HNPS sentence in (32b) is acceptable because the rule applies to NP in the rightward direction, which makes the recognition of VP earlier.

The EIC is better than the prosodic condition (26) proposed by Z&I in that (i) it does not refer to the absolute weight of a shifted phrase, and (ii) it can be generalized to apply to

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[8]   The main argument of Hawkins (1990) is that the EIC is one of the innate processing mechanisms which is reflected in the cross-linguistic regularities of word order.

EXNP examples.[9] However, the obvious problem with the EIC is found in its word-counting system. The EIC concerns *syntactic* processing only, measuring the weight by the number of syntactic words. It cannot predict the different acceptability among sentences that contain the same number of syntactic words, such as the following:

(34) a. John gave to her [the report on   ?Jim/HIM/*him/ME/?-*me].
     b. A book came out [by   √-??Irene Heim/HER/*her/ME/*me].

This type of contrast is a potential problem for any syntactic approaches to the weight effect (e.g. Wasow 1997, Tokizaki 2000).

4. A Proposal

4.1. *The Prosodic Structure in English*

Before proposing an alternative to the previous studies surveyed in the preceding section, let us look at the prosodic structure in English. Zec and Inkelas (Z&I, 1990) use a prosodic unit, namely the phonological phrase (Φ), in formalizing the constraint on Heavy NP Shift (HNPS). However, it is not clear from their argument how phonological phrasing is done in English. The phonological phrasing algorithm in Z&I says that "prominent elements are mapped into their own phonological phrases" (Z&I:370), but the term "prominent" is not given a clear definition. For present purposes, I focus on the level of the prosodic word (PWd) in English.
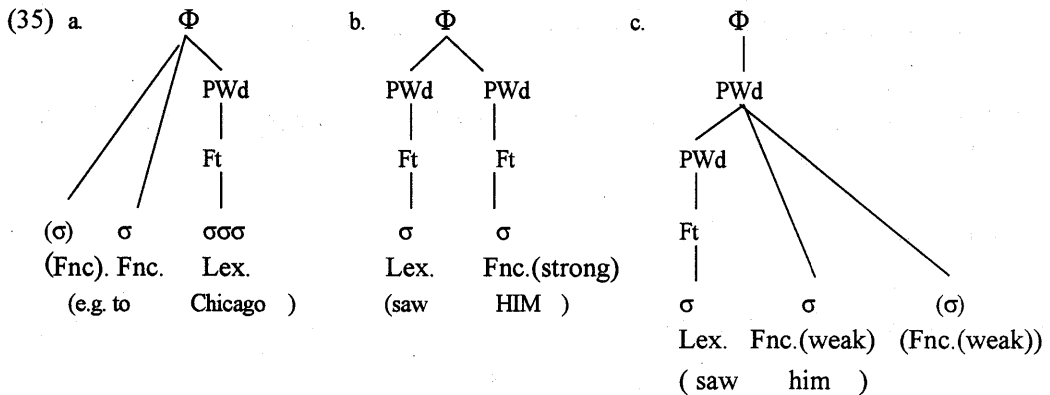
4.1.1. Prosodic Words

The term "word" is very general and needs to be defined. This paper discusses only prosodic words and syntactic words on the reasonable assumptions that (i) there is a distinction between them in English, and (ii) other possible definitions of word, including "morphological words, orthographic words, free forms, listeme" presented in Di Sciullo and Williams (1987) are irrelevant to the present discussion. The distinction between prosodic words and syntactic words is strongly motivated by the behavior of function words, such as prepositions, pronouns, complements, determiners, and conjunctives (cf. Gee and Grosjean 1983, Selkirk 1986:387). I assume, along with Selkirk (1996), that the distinction between lexical and function words is prosodic in nature: if a syntactic word is always prosodically

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[9]   See Shiobara (1997) for how the EIC applies to EXNP examples in English.

strong, it is always footed, and it is a lexical word. If a syntactic word is not always prosodically strong, it is not always footed, and it is a function word.[10] [11]

Selkirk (1996) proposes the following prosodic structures for the sequence of a monosyllabic function word (Fnc) – a lexical word (Lex), and a lexical word – a monosyllabic function word:

(35) a.

Φ
PWd
Ft
(σ) σ σσσ
(Fnc). Fnc. Lex.
(e.g. to Chicago)

b.

Φ
PWd PWd
Ft Ft
σ σ
Lex. Fnc.(strong)
(saw HIM)

c.

Φ
PWd
PWd
Ft
σ σ (σ)
Lex. Fnc.(weak) (Fnc.(weak))
(saw him)

The structure in (35a) is that of a Fnc - Lex sequence. The structures in (35b) and (35c) represent those of Lex – Fnc word sequence. A monosyllabic function word can be prosodically strong and get a status of prosodic word (PWd) as in (35b) in one of the following three situations: (i) when it appears in isolation, (ii) when it is focused and assigned a pitch accent, and (iii) when it appears in phrase-final position and not an object of V or P.

The phonological phenomena that are considered to be sensitive to the level of prosodic words in English is the stress domain. The stresslessness of a monosyllabic Fnc indicates that it is not a PWd itself. For example, the vowel reduction or the loss of onset *h* is observed in Fnc (e.g. for [fr] Timothy, need him [im]) (Selkirk 1996:193-194). Evidence for (35a) is that a Fnc displays no PWd-initial behavior in that it may be followed by a stressless syllable (ibid.197). In English at most one stressless syllable may occur at the left edge of a Lex as in (36a) whereas sequences of stressless syllables made up by non-phrase-final Fncs are systematically possible as in (36b):

(36) a. mǎsságe, Màssǎchúsetts, *Mǎssǎchúsetts

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[10] It is generally observed that the minimal word restriction (e.g. > [$_{Ft}$ μ μ]) presumes the lexical-function word distinction and applies to lexical words only (cf. McCarthy and Prince 1995:324).
[11] Gee and Grosjean (1983) show that the pause between a lexical word and a function word, or between function words, (within a syntactic phrase) is significantly shorter than that between lexical words in connected speech.

b. ă măsságe, fŏr ă măsságe

Given the generally assumed foot binarity in English (cf. Hammond 1984), a stress domain, consisting of at most one primary stress and at most one secondary stress, can contain at most six syllables even if one extra syllable per foot is allowed (e.g. $\sigma(\acute{\sigma}\sigma)(\grave{\sigma}\sigma)$ as in *Elizabeth*, $(\grave{\sigma}\sigma)\sigma(\acute{\sigma}\sigma)\sigma$ as in *elephantiasis*). Now let me tentatively define the prosodic word in English as in (37):

(37) PWd$_{df}$: prosodic Word (PWd) in English is a stress domain that contains i) one and only one primary stress, ii) at most one secondary stress, and iii) at most six syllables.

Furthermore, the initial position in PWd is often associated with effects involving the phonetic realization of segments (Selkirk 1996:197-198). In English, a PWd-initial voiceless stop is aspirated even when the syllable to which it belongs is stressless as in (38a), which is not attested in initial position in weak non-phrase-final Fncs as in (38b):

(38) a. grow t^{h}omatoes, grow p^{h}etunias, grow c^{h}alendula
     b. they grow t(*^{h})o the sky.

The /t/ in (38b) is not aspirated but flapped.[12]

On the other hand, the structure of (35c) is motivated by the fact that both a Fnc and a preceding Lex display prosodic word-final behavior, for example, the appearance of intrusive *r*. Intrusive *r* appears in two contexts: at the right edge of Lex and at the right edge of a phrase-final Fnc, as in (39a). It never appears at the right edge of non-phrase-final Fnc as in (39b), which cliticizes onto the following word as in (35a) (McCarthy 1993, Shiobara 2000b).
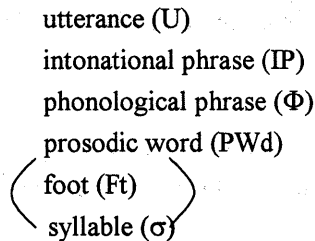
(39) a. The spa-r is broken. Did you-r, or didn't you
     b. Did you-*r answer him?

To sum up so far, the PWd in English is defined as a phonological unit of stress domain, the initial position of which is signaled by the aspiration of a voiceless stop, and the final position of which is signaled by the appearance of intrusive *r*, when other phonological conditions are met.

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[12]   The flapped version of /t/, which is considered to be impossible in Pwd-initial position, is observed in the following lexical words: *today, tomorrow, tonight, together, toward* etc. These words are historically derived *from to -day/ -morrow/ -night/ -gather/ -ward* respectively, suggesting that the initial /t/ may belong to a function word *to* (Bryan Gick, p.c.).

The structures in (35) reflect these phonological criteria of PWds. They presume the presence of prosodic structure with its own prosodic hierarchy (cf. Gee and Grosjean 1983, Nespor and Vogel 1986, Selkirk 1986, Truckenbrodt 1999):

(40)   Prosodic Hierarchy
        utterance (U)
        intonational phrase (IP)
        phonological phrase (Φ)
        prosodic word (PWd)
        foot (Ft)
        syllable (σ)

The prosodic structure is subject to Strict Layer Hypothesis which is decomposed into the following restrictions (Selkirk 1984,1996):

(41) Strict Layer Hypothesis
       a. Layeredness: No C^i dominates a C^j, $j > i$
       b. Headedness: Any C^i must dominate a C^{i-1}
       c. Exhaustivity: No C^i immediately dominates a C^j, $j > i-1$
       d. Nonrecursivity: No C^i dominates C^j, $i = j$

Selkirk (1996) analyzes the structures in (35) in Optimality Theoretic terms. In particular, the structure in (35a) violates the constraint of Exhaustivity (Φ) in that a phonological phrase does not immediately dominate a prosodic word at the left branch. The structure in (35c) violates Nonrecursivity (PWd). So, these two constraints are violable.[13]

The first criteria of PWd, the stress domain, is not precise enough particularly in the following two cases. First, a syntactic word with excessively many syllables is pronounced with more than one primary stress, and stress placement is not always consistent among speakers. For example, according to Akasaka and Tateishi (2000:25) the noun *pneumonoultramicroscopicsilcavolcanocaniosis* is pronounced with four phonological phrases, and hence presumably with four prosodic words, as in (42c):

(42) a. I looked up [pneumonoultramicroscopicsilcavolcanocaniosis] in the dictionary.
      b. √-?I looked up in the dictionary [pneumonoultramicroscopicsilcavolcanocaniosis].

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[13]   Having the constraint Nonrecursivity violable, we need not postulate a further level such as "clitic group" between Φ and PWd (Selkirk 1996:188, fn.3).

c. [pneumonoultra]PWd [microscopic]PWd [silicavolcano]PWd [caniosis]PWd

However, a native speaker I talked to preferred the following break-up even though the third prosodic boundary does not match the morphological boundary:

(43) [pneumonoultra] [microscopic] [silicavol] [canocaniosis]

Given the definition in (37), the word, which consists of eighteen syllables, should contain at least three PWds (18÷6=3) wherever the prosodic word boundaries are. The voiceless stop /k/ in ...*volcano*... is lightly aspirated and so is the /k/ in ...*caniosis*. This suggests that both of the prosodic boundary in (42c) and (43) are real.[14]

The second tricky case is the sequence of monosyllabic Fncs.

(44) Q: What did John give to Sue?
   A:
       a. John gave [the report on me] to her.
   b. ?-*John gave to her [the report on me].

In (44a), with the basic V-NP-PP order, there is a sequence of four monosyllabic Fncs, *on me to her*. This sequence consists of four syllables, and hence can be within one PWd by the definition in (37). However, the voiceless stop /t/ in *to* is flapped here and hence it does not signal the left edge of a PWd. In contrast, the voiceless stop /t/ in *to* in (44b) is aspirated, which suggests that it does not cliticize onto the preceding verb *gave*.

(45)   prosodic structure

a.

   ... the report on me to her

b.

   ... gave   to her the report on me

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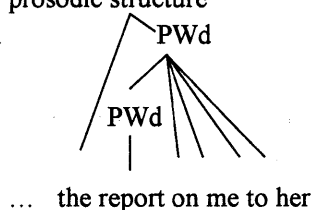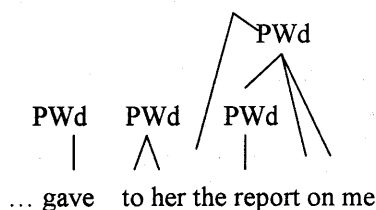
[14]   Ola (1995) proposes that a "maximal word" in Benue-Congo languages is a binary foot, based on the evidence from the maximal size of roots, affixes, hypocoristics, and clefted nouns:

(i)   PWd
      ∧
      Ft Ft

If the prosodic structure in (43) is correct, the first PWd contains five syllables and this suggests that the constraint PWd-BinFt, which says that a PWd consists of a binary foot, is ranked lower in English.

Therefore, although the prosodic structures in (35) give us the general idea of how function words behave prosodically, the phonological signals of PWds still need to be looked at in each example.

4.1.2. Syntax-phonology Mapping

As we have just seen, the discrepancy between syntactic structure and prosodic structure is found with respect to the lexical (Lex) vs function (Fnc) word distinction. This suggests that the constraints on syntax-phonology mapping should make reference to the notion of "lexical" words in particular, given that only Lexs are always mapped to prosodic words (PWds). Selkirk (1996:192), for example, proposes the optimality theoretic constraint that refers only to Lex: Align (Lex, L; PWd, L), Align (Lex, R; PWd, R). Note here that the Lex vs Fnc distinction is taken for granted and available in stating universal constraints, which leads her to say that "the language learner could conceivably exploit *phonological* knowledge in learning something about the *syntax* of the functional-lexical distinction" (Selkirk 1996:209-210). This paper adopts Selkirk's prosodic distinction between Lex and Fnc (as I noted so in 4.1.1). These Align constraints are two particular instances of McCarthy and Prince's (1993) Generalized Alignment constraint:

(46) Generalized Alignment   (cf. McCarthy and Prince 1993)
    Align (αCat, E; βCat, E)
(α, β categories ranges over morphological, syntactic, prosodic categories; E = Right or Left).

Moreover, Truckenbrodt (1999) explicitly hypothesizes a principle that constraints relating syntactic and prosodic structure apply to lexical elements and their projections only:

(47) Lexical Category Condition (LCC)
    Constraints relating syntactic and prosodic categories apply to lexical syntactic elements
    and their projections, but not to functional elements and their projections.

To be precise, I define a Lex syntactically as a syntactic word that is dominated by a lexical head, e.g. N, V; while a Fnc, a syntactic word that is dominated by a functional head, e.g. Det, I, P.[15]

Other than function words, the natural assumption is that the mapping should be as transparent as possible. For example, a syntactic word is mapped into a prosodic word, a

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[15]   The status of P is not uncontroversial. Here I regard P as a functional head given that prepositions are not always prosodically strong (cf. 4.1.1).

syntactic phrase is mapped into a phonological phrase, and so on.

4.2. The Relative Prosodic Weight[16]

This subsection proposes an alternative approach to the weight effect in Heavy NP Shift (HNPS). The new approach will be formalized in terms of the Phonetic Form (PF) side of sentence processing so that the problems of the previous studies we saw in section 3 can be reconciled.

In section 3, we saw that Hawkins' processing approach to the weight effect is more adequate than the prosodic approach by Z&I in that the former captures the fact that it is the *relative* weight of sentence-final phrases that matters in English sentences. However, the obvious problem with Hawkins' Early Immediate Constituents (EIC) is its word-counting system. EIC measures weight by the number of syntactic words and hence cannot predict the different acceptability between (48a) and (48b) for example, which was originally pointed out by Inkelas (1989:17-18):

(48) a. Mary gave to Sue [the report on Jim].

      b. ??Mary gave to Sue [the report on him].

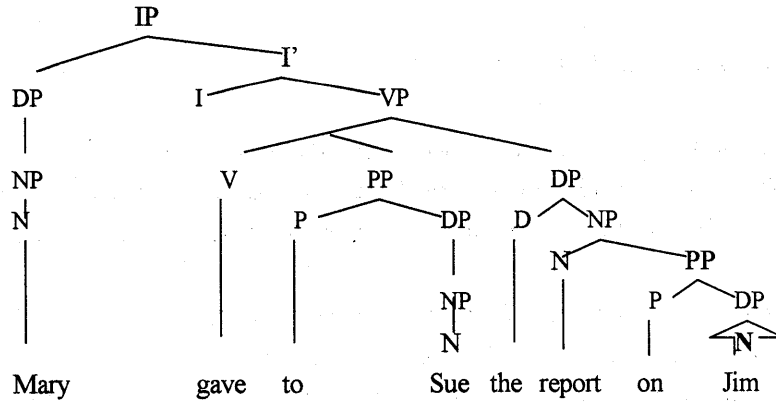Let us look more closely at the syntactic and prosodic structure of each sentence in (48).[17]

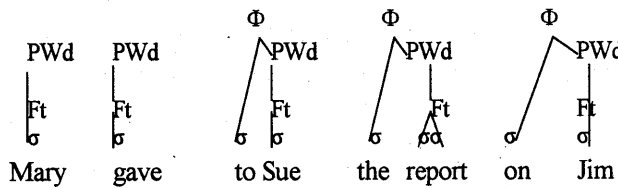[16] The idea of this proposal is developed from Shiobara (2000a, 2001).

[17] The structures gloss over the irrelevant details, such as the syntactic structure for double objects and the prosodic levels above prosodic words. One point worth noting is that a shifted NP forms an independent intonational phrase prosodically. This is evidenced by the fact that (i) speakers tend to pause before a shifted NP, and (ii) a parenthetical expression can occur right before a shifted NP (but not before a PP) (cf. Nespor and Vogel 1986:188, Rochemont and Culicover 1990:119):
(i) a. John bought for Mary, I think, [a picture of her father in a weird costume].
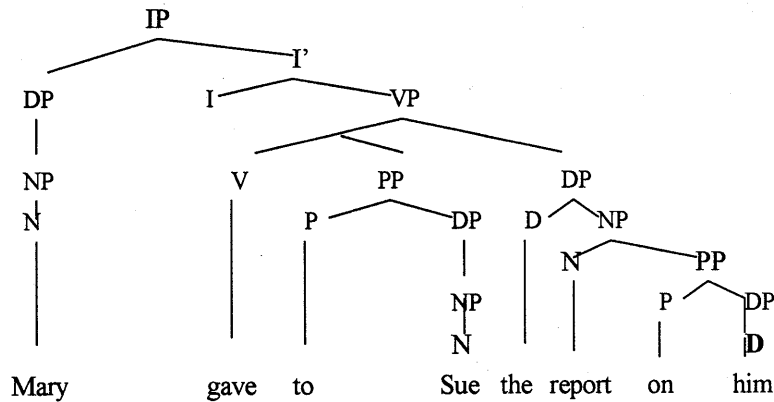   b. *John bought, I think, for Mary [a picture of her father in a weird costume].

(49) a. syntactic structure
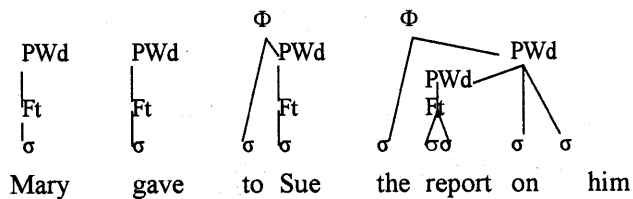
IP
  DP   I'
      I VP
NP   V   PP   DP
N   P DP   D NP
               NP   N   PP
               N   P DP
                               N

Mary   gave to   Sue the report on   Jim

b. prosodic structure

            Φ   Φ   Φ
PWd PWd   PWd   PWd   PWd
Ft   Ft   Ft   Ft   Ft
σ   σ   σ σ   σ σσ σ   σ
Mary gave   to Sue the report on Jim

(50) a. syntactic structure

IP
  DP   I'
      I VP
NP   V   PP   DP
N   P DP   D NP
               NP   N   PP
               N   P DP
                              D

Mary   gave to   Sue the report on   him

b. prosodic structure

            Φ   Φ
PWd PWd   PWd   PWd
Ft   Ft   Ft   PWd
                    Ft
σ   σ   σ σ   σ σσ σ   σ
Mary gave   to Sue the report on   him

The crucial assumption made in distinguishing between (48a) and (48b) is that the proper name *Jim* is a lexical word dominated by the syntactic head N (see (49a)) whereas the pronoun *him* is a function word dominated by the syntactic head D (see (50a)). According to

LCC in (47), the former is mapped to a PWd in the prosodic structure but the latter is not. Note in (50b) that the lexical word *report* constructs a PWd with the following function words. (See (35c) in 4.1.1.) Here an additional condition on the syntax-phonology mapping is necessary such as the following:

(51) A lexical projection that contains a complement that is made up of only functional
    head(s) and projection(s) is mapped into a prosodic word.

The condition in (51) correctly predicts that the lexical projection NP *report on him* that contains a complement PP is mapped into a prosodic word. Assuming that the prosodic structure respects the syntactic structure (cf. 4.1.2), the possibility that the determiner *the* cliticizes onto the preceding noun *Sue,* over the phrasal boundaries PP-DP does not have to be considered when there is the noun *report* available within the same syntactic phrase, DP.

    In (49b) the postverbal phrases, PP and DP, consist of one PWd and two PWds respectively. On the other hand, in (50b) both phrases consist of one PWd. Note that the DP does not consist of two PWds because one is dominated by the other. Given this prosodic difference, I modify Hawkins' Early Immediate Constituents (EIC) prediction (cf. 3.2) in prosodic terms:

(52) If a grammar encodes a rearrangement rule (e.g. HNPS), the rule will apply in the
    manner that will increase the number of PWds toward the end of the sentence.

For the moment, let me limit this prediction to English. (Cross-linguistic predictions will be considered in 5.1.) In the light of (52), the HNPS in (48b) is predicted to be illegitimate because the number of PWd is the same between PP and DP, hence *does not increase* with a shifted DP in sentence-final position (1 PWd in PP and 1 PWd in DP). In other words, this HNPS does not contribute to the increasing weight effect of the sentence, which in turn does not make the recognition of immediate constituents of VP earlier or easier. In contrast, the HNPS in (48a) is legitimate because the number of PWd increases from 1 in PP to 2 in DP toward the end of the sentence.

    Now, let us turn to acceptable examples in (53), where a Fnc (pronoun) carries prosodic prominence (i.e. pitch accent):

(53) a. Mary gave to Sue [the report on HIM].
            (pointing at Bill in front of the speaker)
   b. Mary gave to Sue [the report on ME].

How can we explain the legitimacy of HNPS in sentences in (53)? One possible way is to syntactically distinguish a Fnc with a pitch accent from a Fnc without one. For example, a pronoun with a pitch accent heads N as a lexical noun does, whereas a pronoun without one heads D. However, this is not a welcome move for two reasons. First, assigning different syntactic categories to Fncs depending on whether one carries prosodic prominence or not requires that non-lexical phonological information should play a role in determining the syntactic structure. This is contrary to the autonomy of the syntactic component. Secondly, with or without prosodic prominence, pronouns are the same in terms of the truth-conditional semantics.[18] If pronouns can have two different syntactic structures, it is wrongly predicted that they would possibly map into two different logical forms.

Alternatively and more naturally, we can assume that pronouns with prosodic prominence achieve the status of PWd in the prosodic structure.

(54) a. syntactic structure
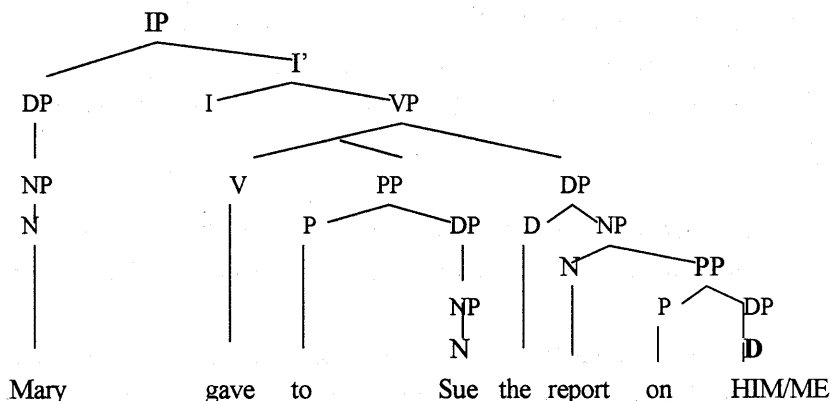
b. prosodic structure
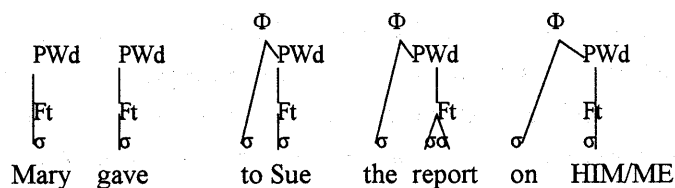
This way, the HNPS in (53) is predicted to be legitimate as it is in (48a). A stipulation required here is that a Fnc forms an independent PWd in the prosodic structure when it carries prosodic prominence.

The importance of the increasing weight effect or the "relative" weight effect is more

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[18] They can be truth-conditional semantically different if the focus effect kicks in. Since my position in this paper is that the end-weight effect is independent from the end-focus effect (see 2.2), I will put the issue of focus aside here.

obvious in the following examples (cf. 2.1):

(55) a. ?He showed to John [some letters from Paris].

    b. ?*He showed to the man who was sitting next to him [some letters from Paris].

In (55a), the PP and the DP consist of one (*John*) and two PWds (*letter, Paris*) respectively conforming to the increasing weight. In (55b), however, the PP consists of at least three PWds (*man, sitting, next*) and the weight is decreasing toward the end of the sentence.

So far counting the number of prosodic words has been successful in accounting for the increasing weight effect in HNPS. What about other levels of the prosodic structure, i.e. syllable, foot and phonological phrase? In 2.1, we saw that the number of syllables or feet does not seem to be relevant to the weight effect in HNPS unless the number of syllables in a syntactic word is excessively big, e.g. √-?I looked up in the dictionary [*pneumonoultramicroscopicsilicavolcanocaniosis*]. Even for this excessively long word, the PWd-counting makes the correct prediction because the word actually consists of at least three PWds as we saw in 4.1 above. Accordingly the sentence achieves the increasing weight effect, with PP containing one PWd and DP containing five PWds, and is predicted to be acceptable.[19] [20]

Finally a brief note about another rearrangement in English, Extraposition from NP (EXNP) (cf. 3.1).

(56) Q: By whom did a book come out yesterday?

    A:

        a. √-??A book came out [by Irene Heim].

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[19] Wheeldon and Lahiri (1997) show by experiments that the effects of number of prosodic words in sentence production is observed when syntactic structure, number of lexical items (i.e. morphological words), and number of syllables are held constant. Their findings are consistent with the hypothesis that the prosodic word is a unit of processing during the phonological encoding of connected speech, i.e. speech production. So far, my proposal of the prosodic EIC concerns sentence comprehension only and does not make predictions about speech production.

[20] Selkirk (2001) shares the basic idea that relative weight should be evaluated in terms of prosodic constituents. She says that the weight relevant to HNPS is determined at the Major Phrase (MaP) level, and weight of MaP is measured, provisionally, in terms of PWd count. In her system, however, MaP includes a subject NP, which seems irrelevant to the weight effect in HNPS:

(i) Q: Who bought what for Sue?

    A:

    a. √-?John bought for her [a house in the trees].

    b. √-?Her ex-husband bought for her [a house in the trees].

    c. The man who proposed to her last week bought for her [a house in the trees].

Contrary to Selkirk's proposal which predicts that HNPS is better when a subject NP is relatively shorter, the sentence in (ic) with a longer subject is better than or as good as those in (ia) and (ib) with a shorter subject.
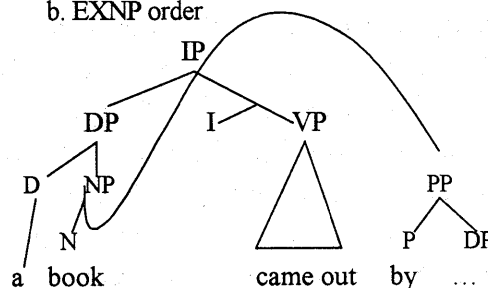
b. A book came out yesterday [by HER/*her].

   (pointing out Irene Heim in front of the speaker)

   c. A book came out [by ME/*me].

More complicated than HNPS, EXNP has dual functions from the processing perspective. Let us look at the sytnactic structure for (56):
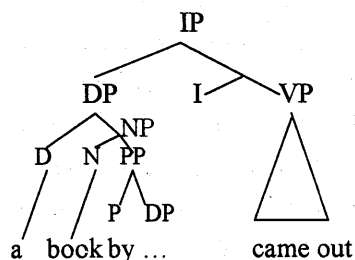
(57) a. basic order   b. EXNP order

The positive function of EXNP is that the recognition of the whole sentence IP that consists of a subject DP and a predicate VP is made earlier by postponing the postnominal modifier after the VP. The negative function is that it makes the recognition of the DP slower by displacing the postnominal modifier into sentence-final position (cf. Hawkins 1994). The rough prediction is that the more PWds a postnominal modifier (the PP in (57)) contains relative to the number of PWds that the intervening VP contains, the more often it is extraposed. This prediction holds for the contrast in (56b) and (56c) because a pronoun with a pitch accent contains one PWd and hence heavier than a pronoun without one that contains no PWd. Moreover, the unacceptable EXNP examples in (56b) and (56c) are bad for yet another reason, that is, that the function words in PP (*by her/me*) need to cliticize onto the preceding lexical word *came* over the syntactic boundaries, VP and PP, because there is no Lex available within the PP:

(58)   prosodic structure

   A   book   came out   by her/me
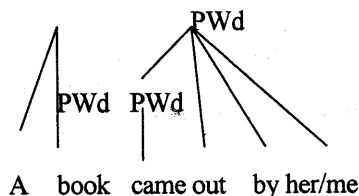
   So far we have no explanation for the variety in acceptability of (56a) or in general. The precise formulation regarding the qualitative difference in acceptability among sentences is

still to be worked out (see Shiobara 1997 for discussion on this).

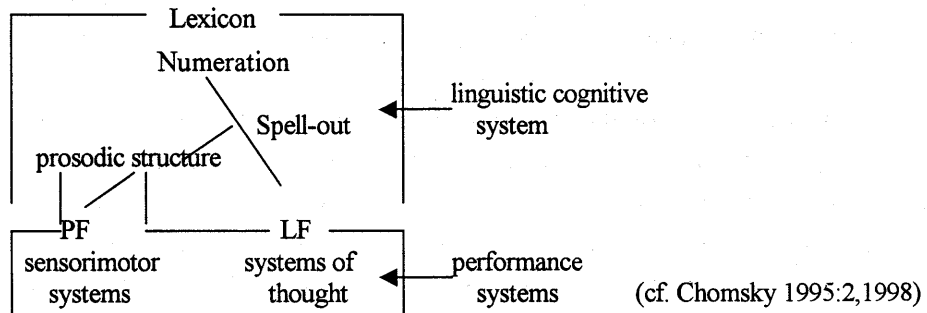## 4.3. The Theoretical Status of the Proposal

My proposal in 4.2 is based on the assumption that the increasing weight effect in HNPS sentences is grounded in processing considerations: given the limit of short-term memory, the human parser prefers minimizing the time elapsed between the first immediate constituent (IC) and the last IC of a relevant syntactic node (cf. Hawkins 1994). Then, what does the acceptability of HNPS sentences tell us? An easy analysis is that both V-NP(DP)-XP and V-XP-NP(DP) orders are grammatical as long as they satisfy the selectional property of verbs, and the sentences that do not conform to end-weight are simply not preferred in use for processing reasons (cf. Pullum and Zwicky 1988:275-276). This approach to HNPS sentences presumes as a research strategy the traditional distinction between competence and performance. On this view, HNPS is considered as optional in the competence grammar whether a HNPS sentence is derived or based-generated.

An alternative analysis is that the sentences that do not conform to end-weight are ruled out in the grammar. The question then is how the grammar distinguishes between them. In measuring the weight of a shifted NP, the parser crucially accesses the prosodic structure, as well as the syntactic structure. It accesses the prosodic structure in counting the number of prosodic words, and it accesses the syntactic structure to know what are the ICs of relevant syntactic nodes. If a derivational theory of human language computation (C_{HL}) is adopted, as in the Minimalist Program (Chomsky 1995 and his subsequent works), the relative prosodic weight effect is conceptually welcome in that it is an instance of PF interface conditions motivated by processing considerations. Chomsky (1995:220) suggests that the level of prosodic structure might be postulated as a post-morphology and pre-phonetics level which can be accessed at the interface along with PF and LF.[21]

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[21] Akasaka and Tateishi (2000:31-32) collapse the level of syntactic structure and prosodic/phonological structure into one Interpretable Tree, which is a set of syntactic trees with phonological and semantic information, even including phonemes (ibid.note 35). This is a radical departure from the modularity/autonomy of components. See also Gazdar (1981) for the same direction of argument in the framework of non-transformational grammar.
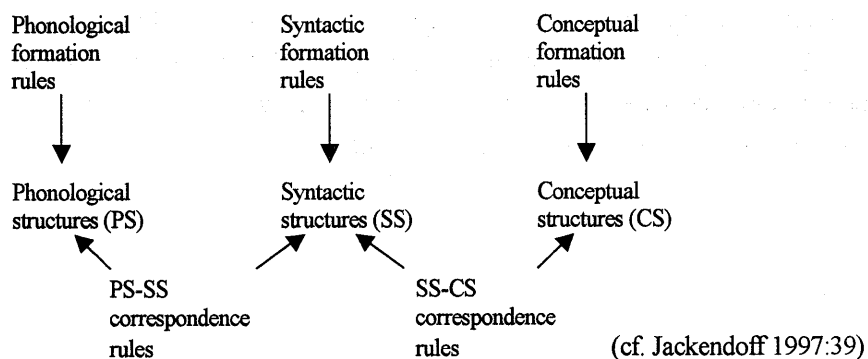
(59) A model of Language Faculty in a derivational theory of C_{HL}

```
         ┌──────── Lexicon ────────┐
         │       Numeration        │
         │           ╲        ┌──── linguistic cognitive
         │            ╲  Spell-out  │      system
    prosodic structure ╲      │
         │      ╱    ╲  │      │
    ┌──PF──────┘─────── LF ────┐
    │ sensorimotor   systems of │──── performance
    │   systems        thought  │        systems        (cf. Chomsky 1995:2,1998)
```

With this kind of derivational theory of grammar, where the syntactic structure and the prosodic structure are derivationally related, the sentences that do not conform to the prosodic weight effect are filtered out at the prosodic structure. The weakness of this analysis is that the prosodic structure needs to contain certain syntactic information, e.g. VP immediately dominates V, NP and XP.

Given the difficulty of accommodating the syntax- and prosody-sensitiveness of the weight effect in a derivational theory, Cohan (2001), among others, takes HNPS as evidence for the architecture of Language Faculty with parallel representations as in Jackendoff (1997).[22]

(60) A model of Language Faculty in a representational theory of C_{HL}

```
Phonological        Syntactic          Conceptual
formation           formation          formation
rules               rules              rules
    │                   │                  │
    ▼                   ▼                  ▼
Phonological        Syntactic          Conceptual
structures (PS)     structures (SS)    structures (CS)
        ↖        ↗         ↖        ↗
        PS-SS              SS-CS
     correspondence     correspondence
        rules              rules          (cf. Jackendoff 1997:39)
```

Under this framework, phonological structure is constrained by syntactic structure in the way

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[22] Taking up HNPS in English, Williams (2000) also argues for representational theory of the architecture of Language Faculty. He claims that HNPS is analyzed not as movement, "but as a mismapping between C[ase]S[tructure] and S[urface]S[tructure] that is licensed by a proper mapping between SS and F[ocus]S[tructure]".

that "syntactic structure X {must/may/preferably does} correspond to phonological structure Y", but not derived from it (Jackendoff 1997:28). There are some aspects of phonological structure that are visible to syntax, and there are still many aspects of phonological structure that are invisible to syntax and vice versa. On this view, only sentences that satisfy syntax-phonology mapping conditions, which include those optimality theoretic constraints and their rankings we saw in 4.1.2, and the relative prosodic weight measuring proposed in 4.2, are grammatical.

We should note that the dynamic/ on-line/ serial character of sentence processing is a separate issue from whether the prosodic EIC can access only one grammatical representation (i.e. prosodic structure in (59)), or more than one structure in parallel (i.e. phonological and syntactic structures in (60)). The point I would like to stress is that the weight effect in English HNPS, is a PF side of interface phenomenon, whether it is placed in the derivational theory (59) or the representational theory (60). HNPS is regarded as a linguistic construction which is motivated by processing considerations.[23] It is a matter of explanatory elegance whether we should adopt the derivation al theory or representational theory of the C_{HL}.

5. Further Issues

5.1. Cross-linguistic Perspective

The basic idea of Hawkins' Early Immediate Constituents (EIC) is that a parser prefers processing of all the Immediate Constituents (ICs) of a relevant syntactic node as soon as possible. In head-initial languages like English, the EIC predicts the preference for short-before-long order, i.e. end-weight. A VP that consists of V, DP and PP for example is the relevant node in Heavy NP Shift (HNPS):
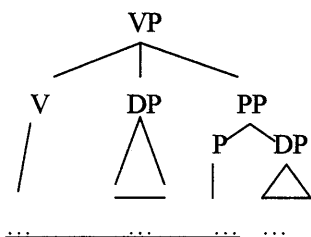
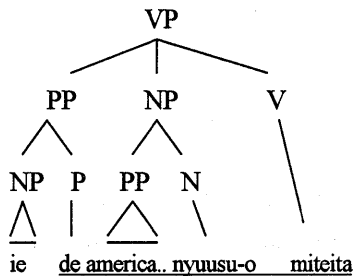(61) a. basic order   b. Heavy NP Shift order

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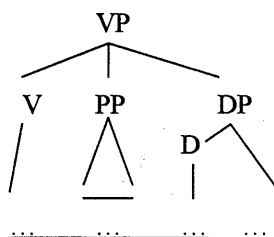
[23]   See, for example, Gazdar (1981), Culicover and Rochemont (1990), Alphonce and Davis (1997), Shiobara (1997), Alphonce (2000) for *non-transformational* approaches to rightward displacement in English.

In (61a) the parser has to process words from V to P that signals the last IC of VP; and in (61b) the parser has to process words from V to D (or a head noun if a determiner is absent) that signals the last IC of VP, which is DP (as indicated with underlines). Therefore, the heavier DP is relative to PP, the longer the recognition of all ICs of VP takes in (61a) and the more frequently the DP is postposed to right as in (61b).

Consider now a head-final language like Japanese. The basic/canonical order for a VP consisting of V, NP, PP is PP-NP-V, but NP-PP-V is also possible as relatively marked.[24] Since heads, which construct phrases, come after complements or modifiers, the EIC predicts that the heavier the object NP is relative to PP, the longer the recognition of ICs of VP takes and the more frequently the NP is preposed to left:

(62) a. Watashi-wa ie-de [america-no tero-kanren-no nyuusu-o] mite-i-ta.
         I-Top. house-at America-Gen.terrorism-related-Gen. news-Acc.watch-be-Past.
         'I was watching the news about the terrorism in the U.S. at home'

     b. Watashi-wa [america-no tero-kanren-no nyuusu-o] ie-de mite-i-ta.
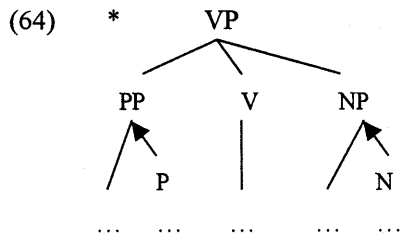
(63) a. basic order   b. Heavy NP Shift order
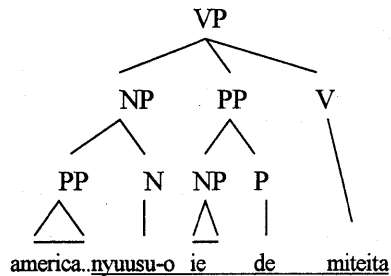
Postposing a long NP to right is not only ruled out by the grammatical principle of head-finality, but also unmotivated by EIC because it does not make the recognition of ICs of VP faster:

(64) *

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[24] The label NP, not DP, is used because Japanese arguments do not usually carry along overt determiners. Whether Japanese arguments are NP or DP is not important to the current discussion.

EIC's long-before-short prediction about Japanese is borne out by the text counts by Dryer (1989) and Hawkins (1994:ch.4.1.5), and on-line experiments by Yamashita and Chang (2001). However, the weight effect is not observed in acceptability judgements by native speakers (cf. Tokizaki 2001):

(65) a. Naomi-wa Ken-ni [sansai-no koro-kara-no shinyuu-dearu Lisa-o]
      Naomi-Top. Ken-Dat. three years old-Gen. time-from-Gen. best friend-be Lisa-Acc.
      shookai-shi-ta.
      introduction-do-Past.
        'Naomi introduced Lisa who has been her best friend since three years old to Ken'
   b. Naomi-wa [sansai-no koro-kara-no shinyuu-dearu Lisa-o] Ken-ni shookai-shi-ta.
(66) a. Naomi-wa otoko-ni [shinbun-de shookai-sare-tei-ta okashi-o] todoke-ta.
      Naomi-Top. man-Dat. newspaper-in introduction-Pass-be-Past. snack-Acc.
      deliver-Past.
        'Naomi delivered the snack which was introduced in the newspaper to the man'
   b. Naomi-wa [shinbun-de shookai-sare-tei-ta okashi-o] otoko-ni todoke-ta.
(67) a. Lisa-wa ashita [jinkoutekini kakou-sare-ta tansokin-ga mitsukat-ta
      Lisa-Top tomorrow artificially modify-Pass-Past. anthrax-Nom be find-Past
      yuubinkyoku-o] otozureru.
      post office-Acc visit.
        'Lisa will visit the post office where anthrax that was modified by men was found
        tomorrow'
   b. Lisa-wa [jinkoutekini kakou-sare-ta tansokin-ga mitsukat-ta yuubinkyoku-o] ashita
      otozureru.

Both (a) sentences with basic order and (b) sentences with HNPS order are acceptable. One speaker even noted that (a) sentences sounded better than (b) sentences to him.

Now the question is how the prosodic measure of weight proposed in 4.2 applies to Japanese. In Japanese, monosyllabic function words are mostly found in case-markers such as –*ga* (Nominative), -*o* (Accusative), etc. and postpositions. Hawkins (1994) counts them as separate words for the theoretical purpose of distinguishing them as mother node constructing words. However, monosyllabic function words in Japanese are prosodically weak and cliticize onto the preceding noun. And furthermore, they are syntactically dependent to the preceding noun as well and never appear on their own, different from English prepositions. In this sense, they do not seem to be a separate unit in sentence processing. But it is a different issue whether the weight effect in Japanese should be captured in prosodic terms or not. Since acceptability judgments by native speakers do not demonstrate the long-before-short

preference, I should test the prosodic measure of weight with corpus data or experiments.

5.2. Light NP Shift

So far, I have been focusing on the end-weight effect in Heavy NP Shift (HNPS) sentences. The prosodic word counting proposed in 4.2 is ahead of the syntactic word counting in predicting the contrast between a proper name and a stressed pronoun on the one hand, and an unstressed pronoun on the other:

(68) Q: What did John give to Sue?
      A:
        a. ?He gave to her [the report on Jim].
        b. He gave to her [the report on HIM/*him].
        c. He gave to her the report on ME/?-*me].

In (68), the question asks what John gave to Sue, and the DP in sentence-final position provides the answer to the question. In other words, these DPs carry informational focus.

My position is that a prosodic approach to the weight effect is adequate as long as the acceptability difference is correlated with the prosodic difference in shifted DPs, even though the fundamental factor is whether a "focus" is prosodically realized or not. In 2.2, I noted that the end-weight effect is independent from end-focus effect, and the former can override the latter. However, I *have not denied* the end-focus effect in HNPS sentences entirely. In fact, there are cases that show a prosodic account is not sufficient:

(69) a. John gave to Sue [a REPORT], not a letter or anything else.
   b. ??-*John gave to Sue [a report].

In (69a) the shifted DP consists of only one prosodic word which is not heavy enough to achieve the increasing weight effect. Furthermore, the prosodic word counting does not predict the contrast between (a) and (b) because both DPs consist of lexical nouns. They are one prosodic word by definition regardless of whether it is stressed or not:

(70) prosodic structure
      a.

b.

```
           /\        /\
  PWd   PWd  / PWd   /PWd
   |     |  /   |   /  |
  John  gave  to Sue  a report
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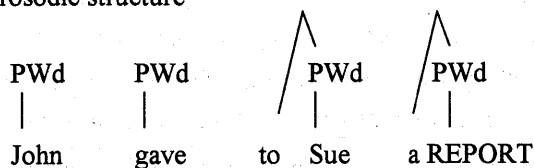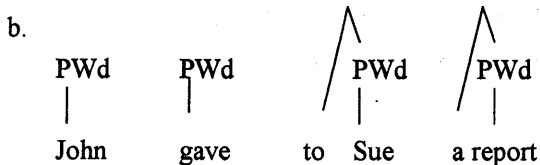
In order to maintain the prosodic word counting for the relative weight effect, we have to make a stipulation, for example, that a stressed common noun consists of two prosodic words. This is purely analysis-driven and undesirable. Looking at the examples in (69) again, the stressed noun in (69a) contributes to providing not only an informational focus, but also a *contrastive* focus and this HNPS sentence is acceptable only with the DP contrastively focused (Chris Tancredi, p.c.). The fact that (69a) is acceptable indicates that a contrastive focus can license HNPS sentences that do not conform to end-weight. If the end-weight effect is called a PF-interface phenomenon, a contrastive focus is regarded as an LF-interface phenomenon that can license a shifted DP in English HNPS sentences, in the sense that it has to do with the semantic or pragmatic property of the DP.[25] The interaction between informational focus, contrastive focus, and weight needs to be further studied.

6. Final Remarks

This paper showed that assessing the weight effect in relative prosodic terms makes correct predictions about the acceptability of Heavy NP Shift sentences (section 4). The remaining tasks include (i) testing the proposal cross-linguistically (5.1), and (ii) testing the proposal with more sentences in English, controlling pragmatic contexts and verb classes (5.2). The discussions in this paper rely on acceptability judgments by a limited number of native speakers only, and it is necessary to collect more judgments of more sentences, look at corpus data, and conduct experiments, now that we are starting to look at subtler differences in the prosodic weight.

The main proposal of this paper is that the relative prosodic weight effect is a PF-interface phenomenon: HNPS is acceptable to the extent that it contributes to processing

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[25]   Another potential factor that is related to the licensing of HNPS sentences has to do with the lexical property of verbs, namely verb disposition. Wasow (1997) distinguishes between verbs that obligatorily take an object NP (=Vt), and verbs that optionally take an object DP (=Vp) and counts the occurrence of HNPS with the two verb classes. Verbs like *bring, carry, make, place, put, set, take* belong to the former, and verbs like *add, build, call, draw, give, hold, leave, see, show, write* belong to the latter according to his classification. The rates of occurrences of HNPS for Vt and Vp are 5.6% and 9.3% respectively, based on a total of 2025 sentences of the relevant types involving these verbs in the Brown corpus (i.e. written corpus); and 1.45% and 3.82% respectively, based on a total of 6000 utterances in the Switchboard corpus (i.e. speech corpus). Thus the result is that an DP which is not obligatorily required is easier to be in sentence-final position, separated from a verb. (See also Stallings et al. 1998 and Hawkins 2001)

efficiency by conforming to end-weight. This implies that the competence grammar is, at least in part, shaped in response to the requirements by performance systems (cf. Hawkins 1994, Shiobara 1997).

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