Reviewing the Binary Branching Hypothesis

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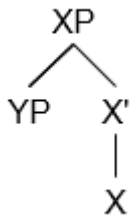
Introduction

The overall complexity of the grammar is one of the fundamental problems in the design of linguistic theory. By Occam's razor, whenever two opposing theories or grammars that have the same descriptive power are formulated, the least complex is generally preferred. Ever since generative linguistics began, several constraints and principles have been formulated to keep the complexity of linguistic theory to a minimum. One of the most important principles that limit the complexity of the grammar in generative linguistics is the Binary Branching Hypothesis (BBH). The binary branching theory is a principle within syntax that restricts the way sentences are derived and represented in tree diagrams. The operation is called binary because it only allows every part of the tree diagram to split into two nodes with one head node and one constituent (two branches) as shown in (1b-d), or alternatively not split and just branch into a single head as can be seen in (1a-c). Flat structures, as shown in (2a-b) cannot be generated when the Binary Branching Hypothesis is adopted.

(1) a)



Unary branching

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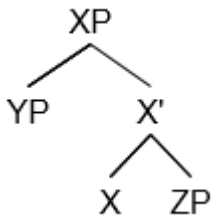
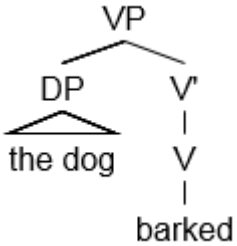


Binary Branching

c)



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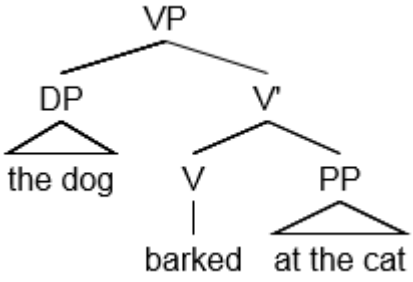
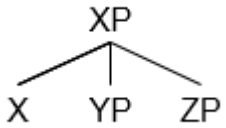


(2) a)



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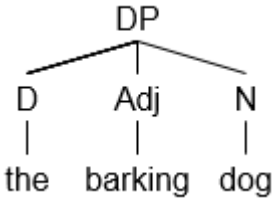
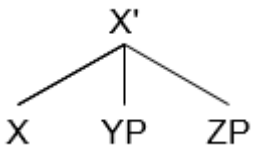


It is generally assumed that binary branching is the most restrictive hypothesis of phrase structures. The BBH has had significant consequences for generative linguistics. Syntactic constituents have generally been considered as binary ever since Kayne's (1981) work about unambiguous paths. Since then, binary branching has been at the base of many lexical and functional projections; it is now considered a fundamental part of X-bar theory, it plays a key part in Larson's (1988) VP shell analysis, and it plays a fundamental part in Chomsky's (1995) Minimalist Program. Theories like the Minimalist Program, which adapt binary branching as a guiding principle, benefit greatly as binary branching minimizes the amount of possible tree structures and provides unambiguous relations between constituents.

While binary branching is generally assumed a priori, this thesis will analyze several arguments that support the Binary Branching Hypothesis.Firstly, several theoretic frameworks that address double object constructions, a structure that has proven to be problematic for the Binary Branching Hypothesis, will be analyzed. Larson's(1988) analysis that relates double object constructions to passives will also be critically analyzed. Finally, the Binary Branching Hypothesis will be examined in relation to possible n-ary word formation processes.

Complements in X-bar Theory

When Chomsky (1970) first proposed the X-bar Theory, and Jackendoff (1977) further expanded it, the theory allowed for more than one complement to a single head. Chomsky's (1970) X-bar Theory itself did not incorporate a binary branching requirement or restriction. Complements are sisters of the head (X). In Jackendoff (1977), an X with two complements would be represented in the following way (3):

(3) 

If a head is able to take two or more complements, then the tree structures are not strictly binary branching, but n-ary branching. The claim that heads are able to take more than one complement is referred to as the Multiple Complement Hypothesis (MCH).

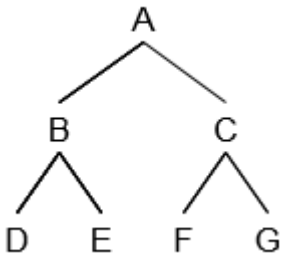
Larson (1987, 1988) and also Kayne (1981, 1984) proposed an alternative to the MCH, called the Single Complement Hypothesis (SCH)(which from now on will be referred to as the Binary Branching Hypothesis (BBH)).This hypothesis states that heads are only able to take one complement. The strength of these hypotheses are tested by determining the explanatory power of their respective analyses. An excellent testing ground for these rival hypotheses is the double object construction.

The binding theory

Before examining double object structures, it is important to give a brief review of the traditional binding theory (Chomsky 1981), as the binding theory plays a key part in explaining the (un)grammaticality of anaphors, reciprocals and negative polarity in double object constructions. The binding theory in best explained in light of anaphors. Rules on

government and binding of anaphors stipulate that an anaphor (i.e *herself* or *each other*) must be bound by its antecedent. Binding is a syntactico-semantic relation in a sentence; a constituent is 'bound' if it is c-commanded by its co-referring antecedent. C-command, introduced into the study of anaphora by Reinhart (1976), is a relation between constituents. Consider the following abstract tree structure:

(4)



The constituentB is considered to c-command its sister constituent C as well as the constituents contained within the sister node, namely F and G. Asymmetrical c-commanding occurs when the constituents do not mutually c-command each other. In (4), for example, F does not c-command B, despite being c-commanded by it. When constituents do mutually c-command each other, like constituent D and E in (4), it is referred to as symmetrical c-commanding.

A good way to illustrate binding is to contrast the pronoun *her*, which has to be free (not bound) in the clause that contains it (or local domain), with the reflexive anaphor *herself*, which has to be bound within the local domain. Moreover, a pronoun cannot be co-referential with a nominal phrase within its local domain. What this means is that *she*, for example, cannot co-refer with an entity within the local domain by which *she* is c-commanded. However, *she* can co-refer with a nominal phrase outside its local domain, this can be either within the sentence or it is possible that *she*co-refers with an entity that is not mentioned in the sentence at all. Consider the following sentences:

(5) Mary said [that Susan loves her].

[Mary] said [that [Susan]$_2$ loves [her]$_1$].

[Mary]$_1$ said [that [Susan]$_2$ loves [her]$_3$].

* [Mary]$_1$ said [that [Susan]$_2$ loves [her]$_2$].

In the sentence in (5), the pronoun*her* can either refer to Mary, or to an entity that is not specified in the sentence itself. However, *her* cannot refer to Susan as Susan is within the local domain of the pronoun (shown by the brackets). Now consider the following sentence:

(6) Mary said [that Susan loves herself].

[Mary]$_1$ said [that [Susan]$_2$ loves [herself]$_2$].

* [Mary]$_1$ said [that [Susan]$_2$ loves [herself]$_1$].

* [Mary]$_1$ said [that [Susan]$_2$ loves [herself]$_3$].

In sentence (6), only one interpretation of *herself* is possible, namely that *herself* refers to Susan, because Susan is within the local domain of the reflexive anaphor *herself.*

The binding theory is an important theory for the Binary Branching Hypothesis, as without it, there is no way to explain why (7a) is a grammatical double object construction, but (7b) is not. Double object constructions will be discussed in the following sections.

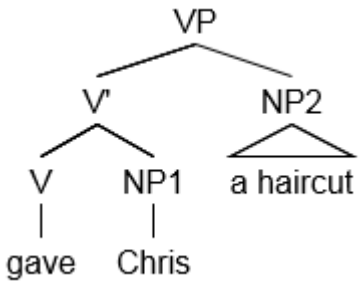
(7) a) John showed Bill himself.

b) *John showed himself Bill.

Double object constructions in English

The binding theory has gotten a lot of attention in connection to double object constructions. A double object construction is a sentence that contains a verb phrase (VP) which has two noun phrase (NP) complements (shown in (8)).

(8)



NP1(*Chris*in (8)) is known as the indirect object andNP2(*a haircut*in (8)) is known as the direct object. Barss and Larsnik (1986) observe a binding asymmetry in English. The following sentences are examples of this binding asymmetry:

(9) a) I showed [the women]$_1$ [each other]$_{1.}$

b) *I showed [each other]$_1$ [the women]$_{1.}$

It is clear that the indirect object can bind the direct object, but not vice versa. This generalization is further supported by other forms of binding. For example, anaphor binding and negative polarity:

(10) a) I showed [Sarah] [herself].

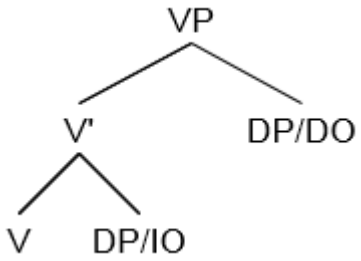
b) *I showed [herself] [Sarah].

(11) a) I gave [no one] [anything].

b) *I gave [anyone] [nothing].

These facts are problematic in the case of English, mainly because the English VP is assumed to be right-branching, as shown in the following binary structure:

(12)



The problem that arises from this structure is that the indirect object does not c-command the direct object. When the indirect object does not c-command the direct object, it is unable to bind the direct object, as failure of c-command leads to failure of binding. In this structure, the direct object c-commands the indirect object. This naturally leads to the prediction that the direct object can bind the indirect object, and not vice versa. However, when we consider the data given above, this prediction is false.

Double object constructions in Dutch

Daalder and Blom (1976) observe the same binding asymmetry between the indirect object and the direct object in Dutch, as shown in examples (13-15):

(13) a) Ik toonde [de vrouwen]$_1$ [elkaar]$_{1.}$

I showed [the women]$_1$ [each other]$_{1.}$

b) *Ik toonde [elkaar]$_1$ [de vrouwen]$_{1.}$

I showed [each other]$_1$ [the women]$_{1.}$

(14) a) Ik toonde [Sarah] [haarzelf].

I showed [Sarah] [herself].

b) *Ik toonde [haarzelf] [Sarah].

I showed [herself] [Sarah].

(15) a) Ik heb [niemand] [ook maar iets] gegeven.

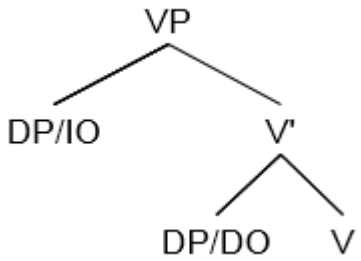
I have [nobody] [anything] given.

b) *Ik heb [ook maar iemand] [niets] gegeven.

I have [anybody] [nothing] given.

According to Daalder and Blom (1976), binding should be analyzed in terms of minimal c-command, which explains the data, as Dutch verb phrases (VP) are left-branching and head-final (Koster 1975). Daalder and Blom (1976) propose the following binary structure:

(16)



This construction provides a straightforward explanation of the asymmetry between indirect objects and direct objects. It shows that the indirect object asymmetrically c-commands the direct object, which accounts for the binding facts, and it also captures the correct word order.

Uniformity of double object constructions

The structure given for English is the exact opposite of the Dutch structure. In English, the indirect object is a sister node of the head (V), while in Dutch the direct object is the sister node of the head (V). In a theory that is meant to capture the structural systems underlying in natural languages, it is unacceptable that double object constructions are assigned a different structure in Dutch from those in English. Baker (1988) has proposed a principle that forces the assumption of the same deep structures for double object constructions in English and Dutch. This principle is called the Uniformity of Theta-Assignment Hypothesis (UTAH):

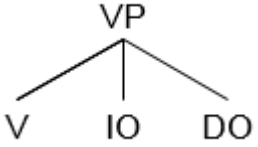
> **U**niformity of **T**heta-**A**ssignment **H**ypothesis:
>
> "Identical thematic relationships between items are represented by identical structural relationships between those items at the level of deep structure"

This principle forbids that double objects constructions have different deep structures in Dutch and in English.

The underlying problem here is that the binding theory cannot be altered in a way to make it work for both English and Dutch, and if it could, then there would still be the problem that double object constructions in Dutch are assigned a different structure than in English.

Instead of adopting the Binary Branching Hypothesis, a flat, ternary branching structure could be adopted:

(17)



The advantage of this flat structure is that double object constructions would be assigned the same structure in both Dutch and English. However, if flat structures were to be used, the indirect object and the direct object would mutually c-command each other. This means that sentences like (9b-11b and 13b-15b) would be grammatical, which is not the case. If we adopt the Binary Branching Hypothesis, the asymmetry between the indirect object and the direct object can be explained. This asymmetry cannot be conveyed in a flat structure.

Contrast between the direct object and the indirect object

In the flat structure analysis proposed by Chomsky (1970), the direct object and indirect object are not easy to classify. The notations Chomsky (1970) proposed ([NP^1, VP] for the indirect object and [NP^2, VP] for the direct object) quite clearly illustrate the problem with a flat structure analysis; there is no structural distinction between the direct object and the indirect object.Another problem with this flat structure is that there is no obvious way to deduce how either object receives the right case, or how the theta roles are assigned. Unless some rule is formulated to distinguish the direct object from the indirect object, it can easily be assumed that any order of objects is possible. However, in English the indirect objects always precedes the direct object.

As Den Besten (1989) and Everaert (1982) show, structural case can only be assigned to the direct object in Dutch. However, in the flat structure analysis it appears as if either object can be assigned structural Case. Hoekstra (1991) presents the following examples:

(18) a) ... dat ik Jan de boeken gaf

that I John the books gave-SG.

b) *... dat Jan de boeken <u>werd</u> gegeven.

that John the books <u>was-SG</u> given.

c) ... dat de boeken Jan werden gegeven.

that the books John were-PL given.

These examples of passivization show that it is the direct object that has become the subject, not the indirect object, as indicated by the agreement (underlined in 18b-c). This is because when a sentence is passivized, the structural case is removed, which forces the direct object to raise to the Spec-TP position, where itis assigned nominative case by T. However, passivization does not remove inherent case, which is assigned to the indirect object.

Hornstein and Weinberg (1981) show some facts from English that attest that the direct object and the indirect object should be distinguished from each other. In English, the direct object tends to resist passivization:

(19) a) He gave Sarah the flowers.

b) Sarah was given the flowers.

c) *The flowers were given Sarah.

As shown in (17), the flat structure analysis proposed by Chomsky (1970) does not distinguish between the direct object and the indirect object. Such a flat structure analysis presumes that there are symmetries between the direct object and the indirect object. However, they are in fact very different and need to be distinguished. If the flat structure analysis were adopted, additional (and hypothetical) mechanisms would need to be introduced to create a clear distinction between the direct and the indirect object. Several mechanisms are suggested. However, none of them seem to accurately solve the issue at hand.

Napoli (1989) proposes the following condition to binding:

> "If X and Y are members of the same argument rung, then Y is within the domain of X if X precedes Y" (Napoli 1989)

The 'argument rung' Napoli (1989) refers to is an argument complex that includes adjuncts and modifiers. The condition Napoli (1989) proposes does correctly predict the indirect object's ability to bind the direct object, as the direct object is preceded by the indirect object. However, Hoekstra notes that there remains an asymmetry between direct objects and indirect objects, even when the precedence condition is obeyed, as is shown by the examples he gives:

(20) a) [Which worker]$_6$ did you deny t_6 his$_6$ paycheck.

b) *[Which paycheck]$_6$ did you deny its$_6$ owner t_6 (Hoekstra, 54).

Just as in the earlier examples given, these two sentences show the irregularity between the direct and indirect objects. The indirect object can bind the direct object, but not vice versa. Jackendoff (1990) proposes to define the Binding Theory in terms of precedence. The c-command condition on binding should be supplemented with a precedence condition. He states that the linear order condition emerges as criterial when there is no structural asymmetry, as in double object constructions (Jackendoff 1990, 430). This way, the distinction between both objects can once again be made if a flat structure in adopted. However, even with this precedence condition, there is no explanation for why *Which paycheck did you deny its owner* is ungrammatical. On top of that, it seems rather odd to define binding both in terms of c-command and precedence. The concept of binding seems flawed if in one situation it should rely on c-command, and in others on precedence. Furthermore, precedence does not seem to solve the empirical problem that has been put forward.

From this discussion it can be concluded that it is highly preferable to adopt the Binary Branching Hypothesis over the Multiple Complement Hypothesis. The Binary Branching Hypothesis allows for a clear distinction between the indirect object and the direct object, whereas such a distinction cannot be made when a flat structure analysis is adopted. Even with the addition of precedence to the binding theory, there is still no way to explain why (20a) is grammatical, and (20b) is ungrammatical using a flat structure analysis.

Several theorists have proposed analyses of how to best analyze double object constructions using a binary framework. Some of these analyses will be discussed in the following sections.

Larson's VP-Shell Analysis

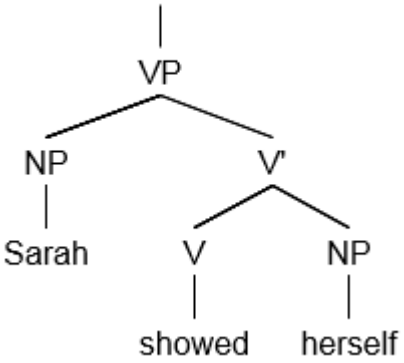
Larson (1988) suggests that in double object constructions, both objects are formed VP internally. Consider the sentences in (10), once again formulated here as (21):

(21) a) I showed [Sarah] [herself].

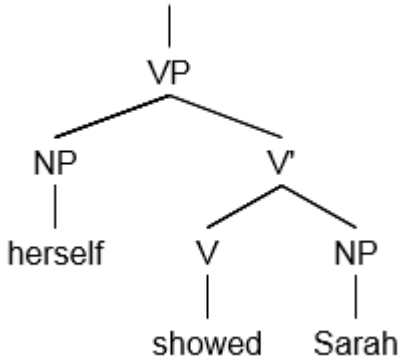
b) *I showed [herself] [Sarah].

Larson (1988) proposes the following binary tree structure for this form of double object constructions:

(22) a)



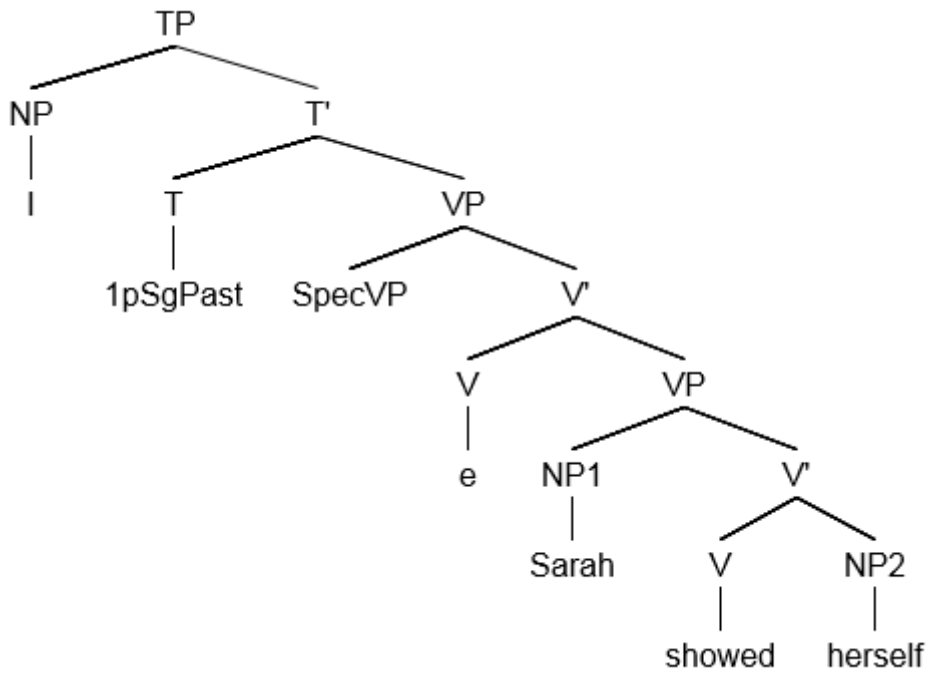
b) *



This form of VP construction appears to solve the problem of the binding of anaphors that has been stated earlier. Because in structure (22a) the NP *Sarah* occupies the specifier position of the VP, the anaphor *herself* is asymmetrically c-commanded. In structure (22b), *herself* and *Sarah* have swapped places and the ungrammatical sentence (21b) is formed. However, according to Kayne (1984), transitive verbs assign case to their complement NPs by virtue of government. This means that there has to be an unambiguous path between the V (*showed*) and the NPs (*Sarah* and *herself*). The structures suggested by Larson (1988) seem to disregard the rules of case assignment that Kayne (1984) has proposed, as in the tree structure above, the V does not govern both of its NP complements, and therefore cannot assign case to both of them. Larson (1988) accounts for this by suggesting V raising; the V raises to the head position of another verb phrase (VP), which is located above the original VP.

This V raising process resolves two issues that the structure suggested by Larson had. Firstly, the V is now able to assign case to the indirect object and secondly, V is now the head of an immediate projection governed by inflection (I), or as more recent works call it, tense (T). This second point is essential as, according to Roberts (1985), V must head a projection governed by T to receive tense and agreement information. This theory has become known as the VP shell analysis, as the outer verb phrase is semantically empty and acts as a shell for the inner VP. Consider the following tree structures to illustrate the V raising that takes place:

(23) a)



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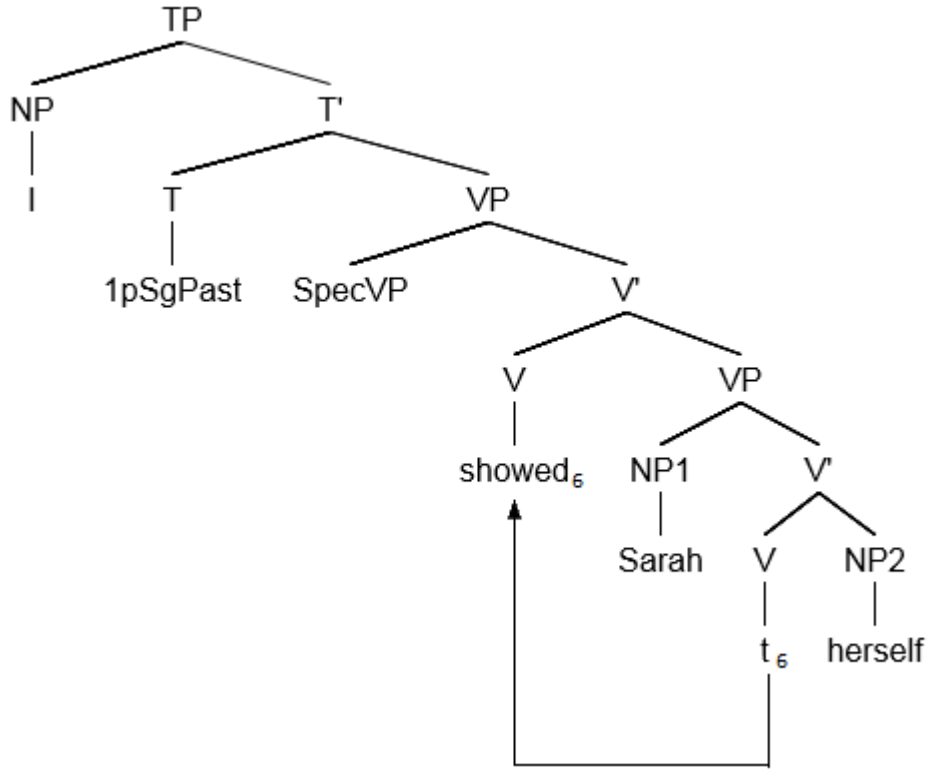


As shown by tree structure (23a), the verb (V) *show* emerges as the head of the lower VP, as a sister to the direct object (NP2) *herself*. This direct object is asymmetrically c-commanded by the indirect object (NP1) *Sarah*, which occupies the lower SpecVP position. Then the V *show* raises to the empty head position of the upper VP (as shown in 23b). This way it is able to assign case to the indirect object, and it heads a projection governed by T. Both of the previously mentioned requirements are now fulfilled.

However, this construction gives rise to another issue; the direct object does not receive case. Larson (1988) resolves this by suggesting that whenever a structure contains a transitive verb (a verb that assigns accusative case), this verb assigns two accusative cases, namely an inherent case and a structural case. To be able to assign structural case, the verb has to be governed by tense (T), and the verb has to govern and be adjacent to its complement. Figure (23b) shows that this is the case once the V has been raised. Consequently, the indirect object (NP1) is assigned the structural accusative case. In order to

assign the inherent case, the verb has to govern and be adjacent to the complement to which case needs to be assigned. Figure (23b) shows that the verb leaves a trace copy of itself, shown in the tree structure as t_6 in the lower VP, which maintains the case assigning properties of the verb. Therefore, the Vtrace assigns the inherent accusative case to the direct object. It is important to realize that the Vtrace is able to govern the direct object as there is an unambiguous path between the two nodes.

Larson's (1988) VP shell analysis appears to solve all the problems that double object constructions pose for the Binary Branching Hypothesis. Larson (1988) offers plausible solutions for the issues of anaphor binding and case assignment in double object constructions, allowing for a binary analysis. Larson's (1988) VP shell analysis is highly preferable over a flat structure analysis, because, as mentioned before, flat structures cannot distinguish between the indirect and direct object, which is problematic for anaphor binding. Furthermore, flat structures also offer no insight in how case is assigned, while Larson's (1988) binary VP shell analysis does explain the assignment of case in double object constructions. Bowers (1993) has adapted and further developed the VP shell analysis, which will be discussed in the next section.

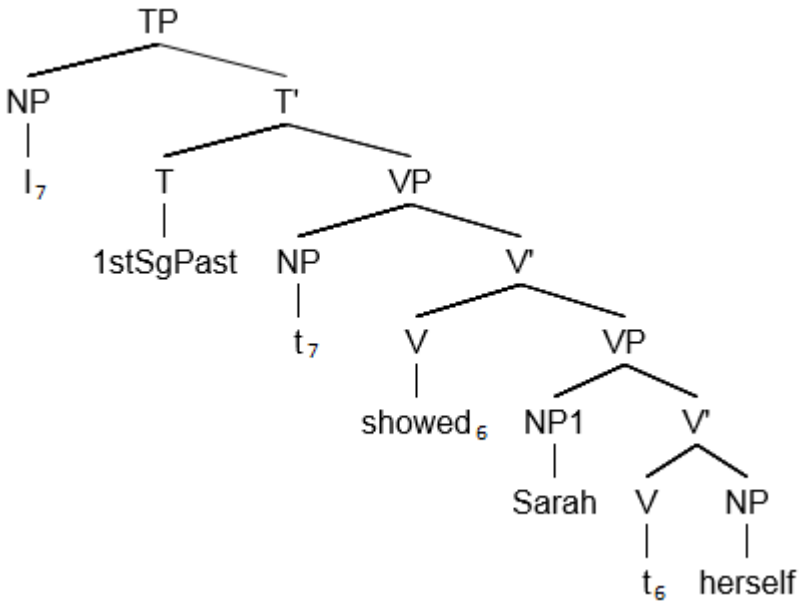
Bowers' Predicate Phrase Analysis

Harley (2007) points out that it is rather questionable that a single verb can project two verb phrases as is the case in Larson's VP-shell analysis. Moreover, Larson (1988) states that the upper VP is a strictly binary construction (342). This raises the following question: which requirement is more important, binary branching, or semantically relevant content? Bowers (1993) has adapted and further developed the VP-shell analysis into his Predicate Phrase Analysis. What Bowers (1993) suggest is that there is a new category, the so-called predicate phrase (PrP), which is situated in between the tense phrase (TP) and the verb phrase (VP).

According to Bowers (1993), the predicate phrase is a category that is located within every clause. The predicategenerally denotes the function of a verb in a sentence. For example, in the sentence *Sarah walked to the park,* the V *walked* is considered to be the predicate, and *Sarah* and *to the park*serve as arguments. The predicate attributes the thematic roles (or theta roles) of walking (the thing doing the walking and the thing that is being walked to) to the arguments. *Walk* is considered a two-place predicate as it has two arguments. *Show*, like in (23), takes three arguments and is therefore considered a three-place predicate.

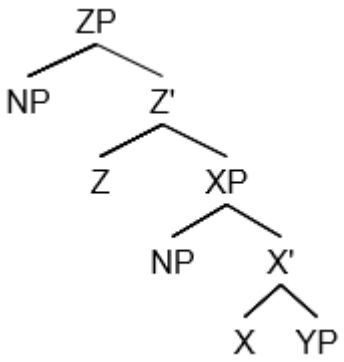
With the Predicate Phrase analysis, Bowers (1993) attempts to integrate the internal subject hypothesis that Kuroda (1988) proposed, in which subjects originate in the SpecVP position before they are raised to the SpecTP position, into a single unified structure that is applicable to both main clauses and small clauses in the binary-branching framework and the X-bar theory. As shown in (24), which adopts the VP-shell analysis, the subject raises from the upper SpecVP position to the SpecTP , while the verb starts in the lower VP and is raised to the upper VP to assign case.

(24)



The predicate phrase (PrP) that Bowers (1993) proposes is meant to create a unified structure for main and small clauses which supports the internal subject hypothesis. He suggests the following structure (25), in which Z represents T in main clauses, and V in small clauses, Y represents V, A, N, or P in main and small clauses, and X represents PrP is both clauses. While this structure does not strictly integrate the internal subject hypothesis (as the subject originates in SpecPrP instead of SpecVP), it is successful in adapting the hypothesis.

(25)

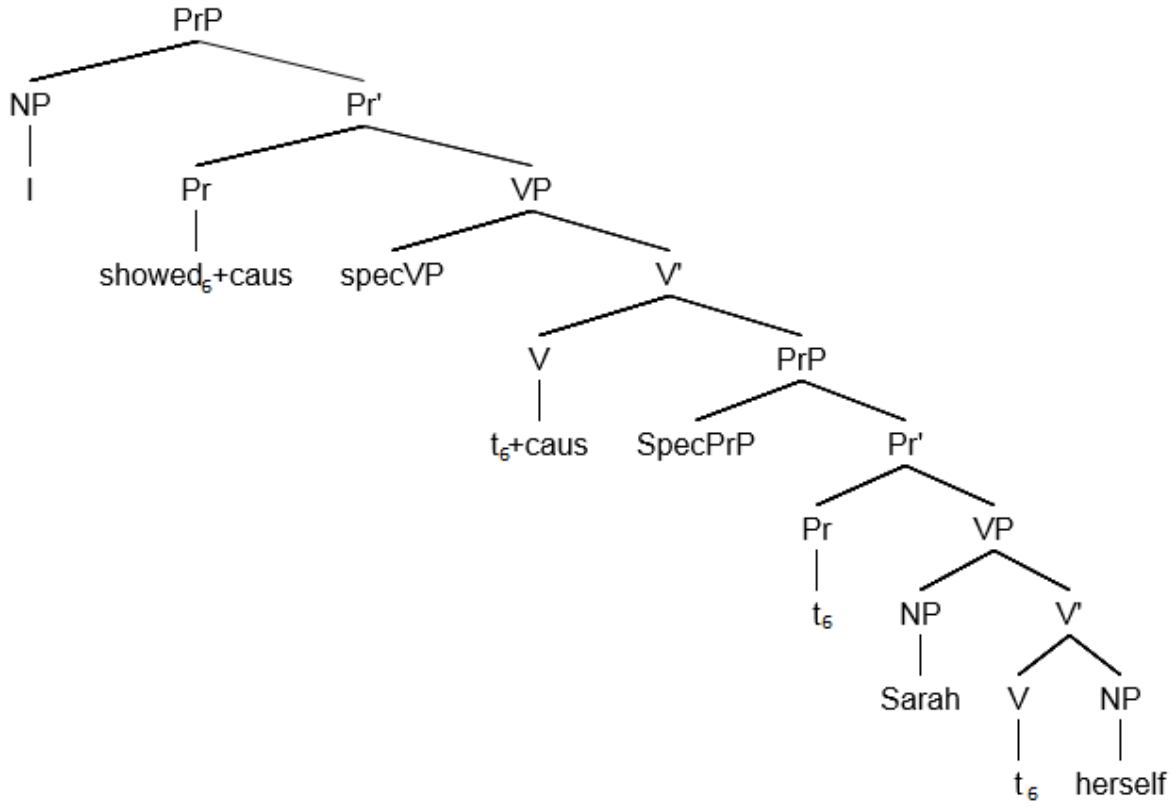


(Bowers 1993, p. 594)

Bowers treatment of double-object structures is best shown through the use of causative verbs. It is assumed that causative verbs have a [+caus] feature that needs to be checked by a phonetically null verb that originates in the structure above the lexical verb. An example of a causative verb is the verb *show*, like in the sentence *I showed Sarah herself*, which is construed to mean 'I caused Sarah to see herself'. Bowers assumes that another phonetically null verb (located above the lexical verb) has to check the [+caus] feature. As, according to Bowers' (1993) Predicate Phrase Analysis, all verb phrases (VP) project a predicate phrase (PrP), and every VP can only have one verb as its head, there has to be a second VP (and PrP) with the phonetically null [+caus] verb. The phonetically null V attracts the lexical V to its position though V raising while adhering to the head-to-head movement

restriction. V raises from the lower VP head position to the lower PrP head position. This way it can assign case to the direct object, and from there the verb is moved by the phonetically null [+caus] verb of the upper VP. The V then finally raises to the head position of the upper PrP to adhere to the requirement of heading a structure that is governed by the TP and to assign case to the indirect object. See figure (26)

(26)



While this seems like a valid structure for double object constructions, it must be noted that this is a very roundabout way of solving the issue of double object constructions in a binary branching theory. It is a very large structure and the verb goes through three movement operations. Considering that linguistic theories are generally meant to be economic, this does not seem to be the best solution to the double object construction in a binary structure. Moreover, there is no real empirical evidence that a predicate phrase category does in fact exist, as the category is never phonetically realized.

Comparing analyses

The previous sections have discussed the double object construction and the problems it poses for the Binary Branching Hypothesis. What has become clear is that a flat ternary branching analysis is not accurate enough to describe double object structures as no clear distinction between the indirect object and direct object can be made. A more restrictive binary branching analysis seemsdesirable as it is able to give a clear distinction between the indirect and direct object.

Larson's VP-shell analysis appears to be a step in the right direction. The construction that is proposed appears to solve the problem of anaphor binding and case assignment to both the indirect object and the direct object. However, the VP-shell analysis does face some problems. One of these issues is that it is questionable that one verb can project two verb phrases, as pointed out by Harley (2007).

Bowers (1993) resolves the issue of projecting two verb phrases by proposing a new category, the predicate phrase. The addition of this category has one big advantage, it allows the creation of a unified structure for both main clauses and small clauses (shown in 21). The advantages of having a unified structure is that it greatly reduces the amount of different structures available in syntax; it is very restrictive. This restrictiveness increases learnability and could in part explain how people are able to obtain the syntax of language rather easily. However, the problem with the Predicate Phrase Analysis is that tree structures become overly large, and verbs often go through several movement processes, which does not conform to the principles of economy that is often preferred in syntactic theories.Furthermore, the addition of a predicate phrase category is very peculiar, as the category is always phonetically null, so it is never phonetically realized. This fact makes it very difficult to find any empirical data that a predicate phrase category does in fact exist.

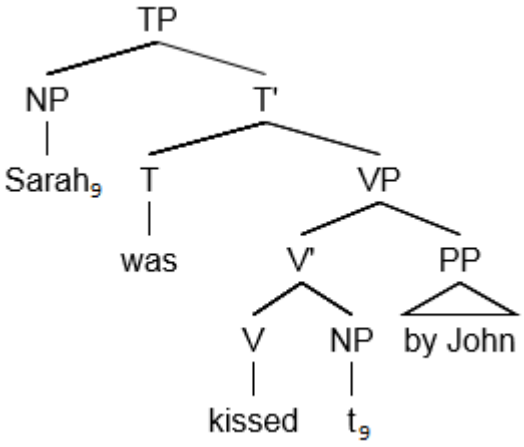
While Larson's (1988) treatment of the double object constructions appears to be the more plausible one, it seems he wants to oversimplify syntactic theory when he draws an analogy between double objects and the passive, which will be discussed in the following section.

The double object construction and the passive

NP+PP complement structures are often considered very similar to the double object construction. Consider the following sentence: *John gave Bill a book*. This double object sentence can easily be transformed into an NP+PP complement structure by reversing the direct object and the indirect object, and adding the preposition (P) *to*: *John gave a book to Bill*. While the sentences appear very similar, and express very similar ideas, it is not clear whether these constructions are generated through the same process. Larson (1988) claims that double object constructions are derived from NP+PP complement structures, through a process that he calls 'dative shift'. According to Larson (1988), this dative shift is an operation that is very much like the formation of passives

The two most important processes used to form the passive are, as Larson (1988) puts it, "withdrawal of Case from an object position, and suppression of thematic role assignment to a subject position" (351). Consider the following sentence: *Sarah was kissed by John*. According to Larson (1988), sentences like this are formed as follows:

(27)

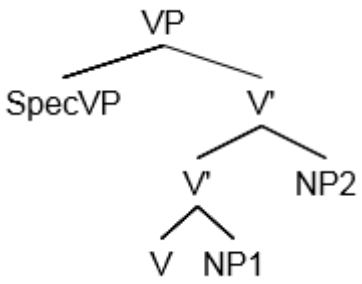


The verb *kissed* occupies the position of the head of the V', as the sister of the NP complement *Sarah*. The VP has the suppressed agent *John* as its adjunct, which takes the case marking preposition *by* to form the prepositional phrase (PP) *by John*. The PP is considered

an adjunct because it is an optional constituent, which means the sentence is still grammatically and semantically correct if the PP were to be omitted (i.e*Sarah was kissed*), but it is spelled out here to give a better demonstration of the similaritiesbetween the double object construction and the passive. The head position of T' is occupied by the auxiliary phrase *was*. Subsequently, the NP *Sarah* is raised to the subject position (SpecTP).

Larson (1988) does slightly alter the verb phrase to get double object tree structure more in line with the formation of the passive. He uses the following structure:

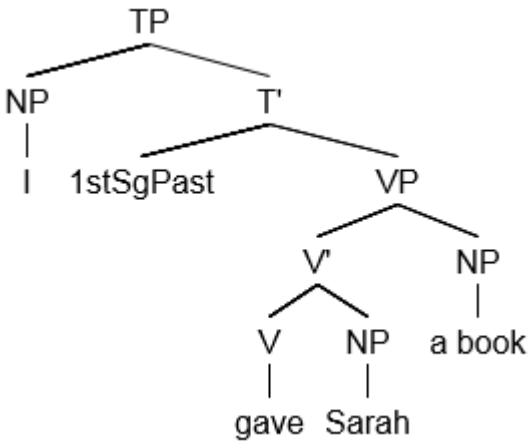
(28)



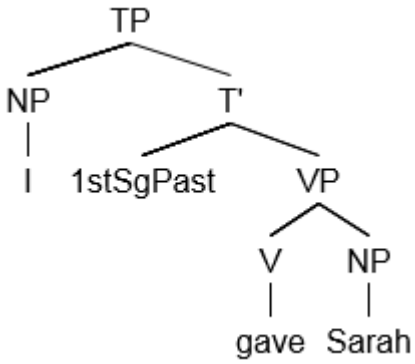
The issue with this structure is that it appears to have been shaped the way it is mainly to make it fit in relation to the passive structure shown in (27). The structure is directly derived from the NP+PP structure (where NP2 is replaced with a PP), shown in (27). Larson's reasoning behind this is that according to him the passive process (27) absorbs the inherent case of the preposition *to*, which removes the case from the indirect object*Sarah*. The direct object (NP2) then undergoes adjunction, explaining why it is a complement of the upper V'. The indirect object then raises from its position as the sister of V into the SpecVP position. Larson suggests that the process of moving the NP to the SpecVP position in the double object construction as in the derivation of the passive shown in (27). The terminology Larson provides for this movement is 'dative shift' for double object constructions, while for the passive he simple calls it passive. However, he does refer to both operations as passive, implying that both of these operations are alternative operations of other structures. The

dative shift is the alternative structure for NP+PP complement structures, while the passive is the alternative structure for the active construction. One of the biggest differences between passives and double object constructions is the ability to suppress the adjunct. The adjunct cannot be suppressed in double object constructions, but this is possible in passives. As shown in the tree structures of the double object construction *I gave Sarah a book* (29a-b) and the passive *Sarah was given a book* (29c-d).

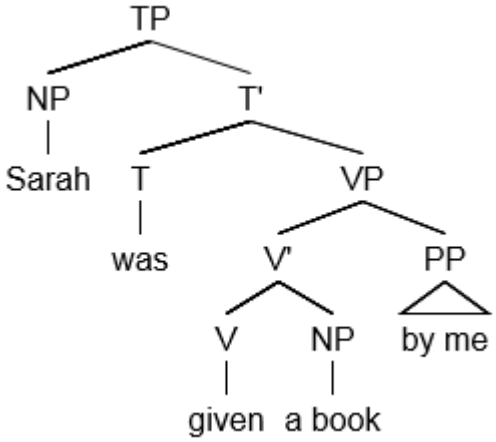
(29) a)



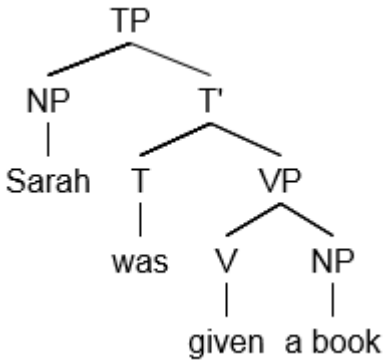
b) *



c)



d) *



Furthermore, there is a difference in form between the main verb in the active form of double objects (*gave* in 29a-b) and the-*en* ending in passives (*given* in 29c-d). Productivity is also more restricted in double object constructions than it is in passives. Virtually every transitive verb can passivize, but very few transitive verbs have double object constructions (see 30).

(30)	a)	Sarah revealed the news to Bill.	(active)
	b)	The news was revealed to Bill by Sarah.	(passive)
	c)	*Sarah revealed Bill the news.	(double object)

These differences show that even though the operations seem very similar, there is enough of a difference to distinguish between the two.

Harley's criticism

Harley (2003) does not agree with Larson's treatment of the passives and double object constructions. She does not think that double objects are derived forms of the NP+PP complement structure through the passive-like operation that Larson has dubbed "dative shift". Harley (2003) refers to the animacy constraint as the central difference between double object constructions and NP+PP complement structures. As discussed above, most double object structures can be transformed into NP+PP complement structures through small alterations. The key difference involves the theta role known as goal, which is the object that the action in the sentence is directed towards. In double object constructions, the goal theta role originates in the inner position, and is moved to the outer position, with the addition of a preposition, as shown in (31):

(31) a) John gave [*GOAL* Bill] a book.

b) John gave a book to [*GOAL* Bill].

The goal theta role is more restricted in double object constructions than it is in NP+PP complement structures. In a NP+PP complement structure the goal theta role can be assigned to either an animate or inanimate object, but in double object constructions the goal theta role can generally only be assigned to animate objects, as shown in (32):

(32) a) *Bill sent [*GOAL* the house] a package.

b) Bill sent a package to [*GOAL*the house].

Harley (2003) implies that the goal theta role in double object constructions is filled by a possessor, whereas in NP+PP complement structures the goal theta role implies a location.

Harley (2003) noted that some of Larson's (1988) "initial evidence for the VP-shell structure comes from the fact that a verb may form a 'discontinuous idiom' with its outer arguments" (38). Some examples of a discontinuous idiom are shown in (33).

(33) a) He *took* me *to the cleaners.*

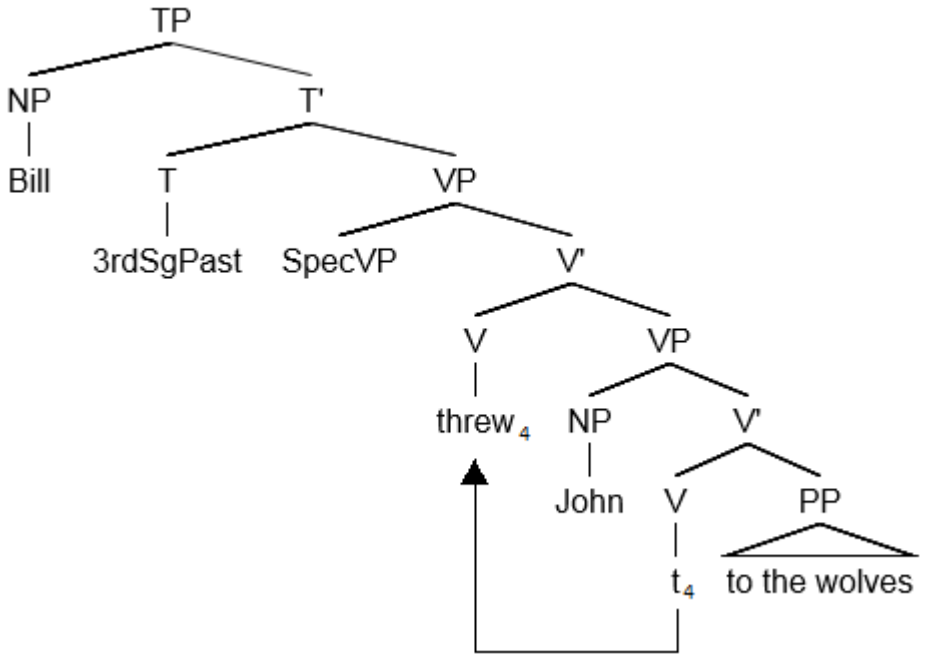
('He bested me')

b) Bill *threw* John *to the wolves.*

('Bill sacrificed John')

According to Harley (2003), "in the formative transformational literature, idiom chunks are a test for movement" (39). This analysis of idioms has allowed Larson to conclude that *threw* has moved from its starting position (as sister node of *to the wolves*), to the left of *John*, as shown in (34).

(34)



Harley (2003) exemplifies idiom chunks and the possible passive transformations through the following examples (35):

(35) *Idioms:*

a) John let the cat out of the bag.

b) The experimenter stacked the deck against his hypothesis.

Passives:

c) The cat was let out of the bag.

d) The deck was stacked against the hypothesis.

(Harley 2003, 39)

As was mentioned before, Larson (1988) claims that double object constructions are derived through a passive-like operation (the dative shift) from NP+PP complement structures. However, if this were the case, it could be expected that NP+PP complement idioms can shift into double object constructions just as freely as passives are formed (see 35a-d), and retain their idiomatic interpretation. Larson's (1988) examples, nor any NP+PP complement idioms, permit such shifting:

(36) a) *He took the cleaners me.

b) *Bill threw the wolves John.

Harley's claim that double object constructions are not derived from the NP+PP complement structure but by independent processes appears to be accurate. Harley (2003) means to show that some idioms can be passivized while keeping their idiomatic meaning, while there are no NP+PP complement idioms that can be transformed into double object constructions using dative shift, which is meant to be a passive-like process, and keep the same meaning.

In conclusion, while Larson's (1988) attempt to find analogies between the so-called dative shift and the passives are admirable, it appears he is too invested in finding ways to strengthen his point of view on the double object constructions in a binary branching framework, that he is willing to overlook several issues with his proposed analogy.

Binary Branching in morphology

The discussion of the Binary Branching Hypothesis will now move from syntax to another generative component of language: morphology. If the Binary Branching Hypothesis proves to be a valid theory in morphology, this does not provide conclusive evidence that it should also be adopted in syntactic theories. However, considering Chomsky's theory of Universal Grammar (UG), which appeals for universal properties of language that simplify the learning of languages based on (binary) parameters (Radford 2009), it could be argued that if a binary branching analysis is adopted in one generative component of language, then it is likely that this is also a valid theory for another generative language component.

The Binary Branching Hypothesis in morphology

The Binary Branching Hypothesis has been embraced by morphological theorists even before binary tree structures were proposed in syntactical structures by Kayne (1984). Aronoff (1976) and Booij (1977) had already introduced binary branching as a constraint on complex morphological structures in the late seventies. Booij (1977) proposed the "one affix a rule hypothesis" for derivational morphology, which claims that word formation rules add only one affix to a word. However, there are some clear examples from Dutch that seem problematic for this hypothesis:

(37) a) boom (tree) geboomte ('group of trees')

b) berg (mountain) gebergte ('group of mountains')

Booij (1977) states that the *ge-te* affix can be considered as a circumfix (or discontinuous affix) as the *ge-* and *-te* separately do not add meaning to the word. More recent work in morphological theory has continuously stressed binary structures to be fundamental to

morphology. As Lieber (1980) states: "there simply seem to be no phenomena in the languages I have examined so far for which n-ary branching lexical structure is necessary" (82).

Possible n-ary branching word formations

Binary versus n-ary branching structure is only an issue in word formation when more than two morphological elements are attached to a stem to form a complex word. There are three ways to arrange the constituents in these sort of complex words:

(38) a) [A + B + C]

b) [[A + B] + C]

c) [A + [B + C]]

There are many complex words that have a clear binary structure because the innermost constituent, the base, is a grammatical and existing word in the language it is part of. A derivational affix is then applied to the complex base. These words pose no threat to the Binary Branching Hypothesis. Some examples are:

(39)	a)	English:	[[pure + fy] + cation]	'purification'
	b)	Dutch:	[weg + [geef + en]]	'weggeven' (to give away)
	c)	Italian:	[in + [mangia + bile]]	'inmangiabile' (inedible)

However, there are several morphological processes that could be considered a threat to binary branching, as such a clear-cut complex base is not found in several words. In the following sections several of these morphological processes will be discussed.

Synaffixation

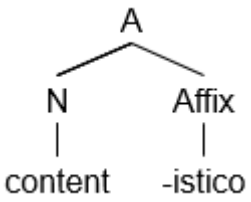
Synaffixation (Booij 2001) occurs when a combination of formally separate morphological elements are simultaneously applied to the base word. These morphological elements behave as a single unit from both a functional and a semantic point of view; the meaning of the morpheme is only realized by simultaneous occurrence of these elements. Guevara (2006) provides some examples from Italian (40):

(40)	a)	ballettistico	'relative to ballet'	?ballett-ista
	b)	contenutistico	'relative to content'	?contenut-ista
	c)	faunistico	'relative to fauna'	?faun-ista
	d)	missilistico	'relative to missiles'	?missil-ista

In these examples two suffixes (-*ista* and -*ico*) are added to a nominal base. According to Guevara (2006), the intermediate sequence (when only -*ista* is added) could be judged grammatical, but it sounds odd.

There are two ways these words can be represented in a tree structure, namely binary and ternary:

(41) a)



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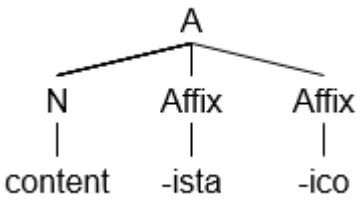
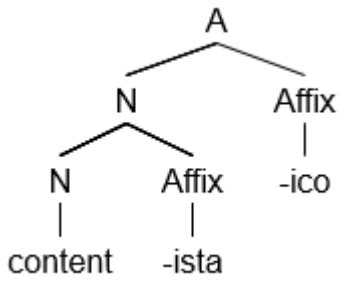


In Italian, the suffix -*ista* can be found separately from -*ico* as well in words like *chitarrista*('guitarist'). However, because only adding -*ista* to the base words does not provide

semantically valid words, it must be concluded that for these words the suffixes are functioning as a single affix unit. Therefore, a binary branching structure should be adopted, despite the fact that two morphological units appear to be applied.

An alternative analysis is proposed by Scalise (1984), whose theory does not allow for synaffixes. Scalise(1984) still proposes a binary structure as he allows for the intermediate step (adding *-ista* first, and then *-ico*), despite the fact that this intermediate form is not always semantically correct:

(42)



Parasynthesis and circumfixation

Parasynthetic derivation occurs when a prefix and a suffix are simultaneously applied to a base. The affixes are independent, both semantically and functionally. Circumfixation occurs when a single circumfix (or discontinuous affix) is applied to a base. Parasynthesis and circumfixation are very similar processes and many morphologists consider them to be synonyms. However, other morphologists advocate a clear distinction, as only a circumfix can be considered a single morphological constituent, while in the parasynthetic process two affixes are applied to a base.

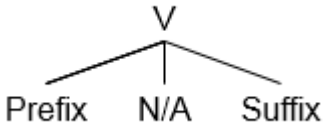
Parasynthesis is very productive in Romance languages. Guevara (2006) provides some examples from Italian:

(43)	a)	ingiallire	(‘turn yellow’)	giallo	(‘yellow’)
	b)	arrossire	(‘blush’)	rosso	(‘red’)
	c)	decaffeinare	(‘decaffeinate’)	caffé	(‘coffee’)
	d)	abbottonare	(‘button up’)	bottone	(‘button’)

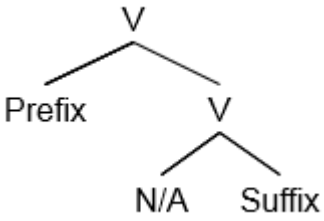
It is important to note that in Romance languages the intermediate derivational steps ([A + B] or [B + C]) are generally unattested and only the [B + C] unit forms grammatical words (i.e example (43b) *arrossire*, *rossire* is grammatical, but **arrosso* is not).

Serrano-Dolader (1999) suggests a ternary branching structure (44a). However, this flat structure is not very explanatory. It is unclear if the affixes form a single constituent or not. Most morphologists adopt a binary branching structure instead (44b), like Scalise (1984). This binary structure is more desirable as it better describes the morphological operation that takes place.

(44) a)

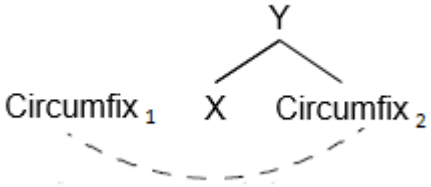


b)

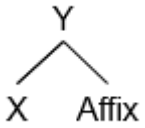


As stated above, circumfixes are generally considered interrupted parts of one morphological constituent (for example the *ge-te* morpheme in Dutch *gebergte*). This view relies on the Separation Hypothesis proposed by Beard (1995), which states that there are two different levels of analysis; morphosyntax and morphophonology. This hypothesis allows specific treatment of cicumfixes: from a morphophonological point of view the affix is split around the base (see 45a), while from a morphosyntactical (see 45b) point of view simply one affix is added. This way circumfixes are no longer a problem for the Binary Branching Hypothesis.

(45) a) Circumfix in morphophonology:



b) Circumfix in morphosyntax:



If the Separation Hypothesis was to be discarded, no distinction could be made between circumfixes and parasynthesis. This would mean that both phenomena would be represented as binary structures like the one in (45b).

It can be concluded that neither synaffixation, parasynthesis nor circumfixation seem to cause empirical problems for the Binary Branching Hypothesis. In fact, these operations can be used to support the BBH.

Compounding

Many linguists, including Jackendoff (2002), consider compounding as a form of 'proto-syntax'. Compound structures are considered to be a transformation from an underlying sentence, which can be realized in sentential syntax. Two separate forms of compounding can be distinguished; coordinating compounding and (para-)synthetic compounding.

Coordinate compounds consist of constituents belonging to the same syntactic category (most frequently nominals) and are generally semantically related. In compounds like these it is generally rather difficult to establish which constituent is the semantic head. The same is true for the syntactic head, though grammatical gender sometimes eliminates this issue in languages in which gender is morphologically marked. Below are some cross-linguistic examples:

(46)	a)	English:	king-emperor	king + emperor	
	b)	Italian:	studente-lavoratore	studente + lavoratore	('student worker')
	c)	French:	chanteur auteur	chanteur + auteur	('singer author')

Much like coordination in syntax, coordinate compounds are recursive and in theory allow for an unlimited amount of coordinated constituents. Guevara (2006) presents the following example:

(47) "The actor-governor-president-icon Ronald Reagan died at age 94"

a) [actor + governor + president + icon]

b) [[[actor + governor] + president] + icon]

c) [actor + [governor + [president + icon]]]

d) [[actor + governor] + [president + icon]]

While an n-ary structure analysis is plausible here, this coordinating compound can also be represented in a binary structure. The advantages of having a binary analysis allows for slight different interpretation of the compound, which could not be captured in an n-ary structure.

Several languages, including Dutch and English, allow for (para-)synthetic compounding. (Para-)synthetic compounds are complex words that are formed using a blend of compounding and derivation. Some examples from Dutch and English are:

(48)	a)	Dutch:	blauwogig	blauw + oog + -ig	('blue-eyed)
	b)	English:	open-minded	open + mind + -ed	
	c)	Italian:	sottamarino	sotto + mare + ino	('submarine)

The analytical problem that arises from these words is that, for example, *-ogig* is not grammatical independently (just like *-eyed* is not grammatical in English). These words are generally analyzed as ternary structures (for example [blauw + oog + ig]). However, when we consider the semantic dimension of these constructs, these words are probably derived from an underlying phrase: $[[\text{blauw} + \text{oog}]_{NP} + \text{-ig}]_{A}$ 'having blue eyes'. Though, when morphophonology is considered, the affix is attached to the rightmost constituent, not the whole noun phrase: $[[\text{blue}]_{A} + [[\text{eye}]_{N} + \text{-ed}]_{A}]_{A}$. It is clear that these parasynthetic compounds could also be considered as binary branching.

Discussing the BBH and morphology

As was shown in the sections above, all the known morphological structures that could potentially be analyzed as n-ary branching structures can very successfully be analyzed as binary as well. The binary branching constructions even appear beneficial, as they prove to be more descriptive than n-ary structures, while also minimizing the amount of possible morphological structures.

While the validity of the Binary Branching Hypothesis in morphology does not provide any irrefutable arguments that the Binary Branching Hypothesis should also be adopted in syntax, because morphology consist of two separate components of language, it does strengthen binarism as a universal element for human language.

Conclusion

In conclusion, this thesis has analyzed several arguments that support the Binary Branching Hypothesis. A problematic structure for the BBH, the double object construction, has been researched by discussing several theoretical frameworks that attempt to find a satisfactory structure for double objects that do not rely on vague or superficial assumptions or restrictions. Furthermore, analogies between the double object construction and passives have been discussed. The BBH has been tested in another generative component: morphology.

Analyzing double object constructions as binary structures has proven difficult. It is important that the analysis is applicable cross-linguistically to comply with the UTAH principle. Furthermore, binary branching analyses should conform to the principles of economy to avoid generating an overly large and complex structure. Larson's (1988) VP-shell analysis seems to adequately solve the issues with the double object constructions, despite the ability of a verb to project two verb phrases being questionable. Bowers (1993) provides an example of how a binary theoretical framework can become overly complicated. While his Predicate Phrase Analysis does provide a unified structure for both main and small clauses, which is preferable considering the fact that it restricts the amount of possible syntactic structures, the theory needs to be adjusted to create structures that are not overly large.

Larson's (1988) analogies between double object constructions appear plausible, but Harley point out that he attempts to draw similarities where perhaps there are few. While it is admirable that Larson (1988) attempts to find similarities between different processes to restrict the amount of possible constructions, making his theory more restrictive, and therefore desirable, it seems he is oversimplifying matters. This is perhaps a good example of Culicover and Jackendoff's (2005) statement that linguists apply the Binary Branching Hypothesis as a comfortable restriction on grammar while focusing on other issues (116).

Morphology appears to support the Binary Branching Hypothesis. This thesis has discussed some of the prime candidates for an n-ary branching analysis and successfully analyzed them in binary constructions. Not only are the binary structures descriptively more accurate, but they also keep the amount of possible morphological structures to a minimum.

While many linguists have embraced the Binary Branching Hypothesis and support it, there are those that do not. Culicover and Jackendoff (2005) presents the Simpler Syntax Hypothesis, an n-ary branching framework as an alternative to mainstream generative grammar, with the goal of creating a less complicated syntactic analysis. The framework presented by Culicover and Jackendoff (2005) does raise the question whether the Binary Branching Hypothesis can still be uncritically used in modern syntactic theories. The question is raised whether the Binary Branching Hypothesis does not overly limit syntax. However, as this thesis argues, binary branching structures have much more descriptive power than flat structures, as shown by the analysis of the distinction between the indirect and the direct object. Therefore, binary branching is highly preferable over n-ary structure analyses.It should be stated, however, that research on more empirical data for the Binary Branching Hypothesis should be done instead of simply adopting the BBH a priori.

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