TOWARDS AN INDUCTIVE APPROACH OF THE MEL'ČUKIAN MODEL
Illustration by the criteria for the syntactic head

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Abstract

This paper analyzes the criteria proposed by Igor Mel'čuk (1988) for determining the syntactic head of a phrase. We show through the analysis of three constructions (relative clause, determiner-noun, coordination) that the surface syntactic structures Igor Mel'čuk postulates do not conform to the criteria he proposes. We study how a more inductive approach would allow us to better adjust the structure to the properties observed in the data.

Keywords: Syntactic head of a phrase, dependency tree, relative pronoun, determiner, coordinating conjunction.

Introduction

The Meaning-Text Theory [henceforth MTT], forever associated with the name of Igor Mel'čuk [henceforth IM], is based on a set of brilliant intuitions of its author. Among these, we can of course mention the choice of a dependency tree to represent the syntactic structure, the semantic graphs of predicate-argument relations, the separation into different levels of representations, the formalization of linguistic rules by correspondence rules between levels, the lexical functions, etc. IM did not of course invent everything, many of the ideas on which MTT is based had been explored before, notably dependency syntax, already well established in the 18th century in the work of Beauzée (Kahane 2019) and taken up by Tesnière (1959) in the middle of the 20th century, or the stratified architecture defended at the same time by Petr Sgall (1967), or were developed in fruitful collaborations, such as the semantic graphs elaborated with Žolkovskij (Žolkovskij & Mel'čuk 1967).

The point we would like to address in this article is the not necessarily inductive nature of many of the assumptions of MTT.[1] An inductive approach is one that starts with the data and makes assumptions based on the observed properties; this is in contrast to a pure hypothetico-deductive method where one validates the assumptions underlying the model by showing that the model can satisfactorily account for the data. In the pure hypothetico-deductive method, it is not necessary to consider all the possible hypotheses, but simply to validate one of them by showing that it makes it possible to obtain the observed results by deduction. By inductive method, we therefore mean a method that seeks to explore all the hypotheses that can lead to a given observation. The inductive approach also includes a hypothetico-deductive phase of hypothesis validation, but it is distinguished from a

[1] Igor Mel'čuk is obviously not alone in not taking an inductive approach. It can be laborious to consider all possible hypotheses and it can be much more efficient to stick to intuition for certain choices. Nevertheless, there comes a point in the development of a theory when one must question one's assumptions. If IM never really questioned the fact that syntactic structure could be anything other than a dependency tree, the same criticism can be made of most linguists who use constituent trees, starting with Chomsky who never bothers to justify the use of a phrase structure tree and does not even seem to consider that there might be other modes of representing syntactic structure.

purely hypothetico-deductive approach by the attention given to the hypothesis induction phase.[2]

The question is particularly sensitive in the case of language modeling, since we have very little access to the mechanisms at work in the speaker's brain, whereas we have an incredible quantity of speakers' productions in the form of texts (written and spoken). We place ourselves here firmly within the framework of corpus-based linguistics, where the model is elaborated from the analysis of texts and their meaning. We must therefore elaborate hypotheses on the functioning of language, unobservable in itself, from the only observables that result.

The assumption that we will question in this paper is the fact that the surface syntactic structure is a dependency tree and therefore a tree. We could still discuss other choices of MTT which do not seem to us to have been the object of an inductive approach: the fact that the surface syntactic dependencies are between words, the nature of the units of the surface syntactic structure (lexemes and grammars), the universal character of the deep syntactic relations opposed to the specific character of the surface syntactic relations, the stratified character of the model and the fact of considering precisely 7 levels. We will not have the space in this short article to develop these other points, which we have already addressed in numerous articles (starting with Kahane 2002).

In this article, we will analyze the way in which several decisions concerning the surface syntactic structure are argued in Mel'čuk (1988). We start with the choice of the dependency tree as a representation formalism (Section 1), then we look at the criteria for the choice of the head of a phrase (Section 2). We then confront these criteria with the head selection in three constructions: relative clause (Section 3), determiner-noun combination (Section 4), and coordinating phrase (Section 5).

1. The choice of a representation formalism

Let us begin with a quote from Paul Garde (1993) about Tesnière (1959):

> In the rest of the book, this notion [the dependency relationship between a governing and a subordinate] is used systematically and applied to all possible connections. He justifies the construction of the stemma, which allows a particularly harmonious and efficient representation of any sentence. But it is finally this pragmatic utility that justifies a posteriori, in each connection, the attribution to one of the terms of the role of governor [Fr. *régissant*] and to the other of the role of subordinate.
>
> On the other hand, we do not find anywhere in the author's work any theoretical justification for this distribution. There is no definition of either term in the whole book, such as: "The governing term is the one who ...; the subordinate term is the one who ...". Even where Tesnière vigorously opposes his own conception of the hierarchical verb-subject relationship to the traditional conception of the egalitarian subject-predicate relationship (pp. 102-105), he only argues for the consequences that both conceptions may have on the economy of the description, but not for a definition of the two terms.

This analysis by Garde of Tesnière's work could in part be applied to IM's work. While Tesnière is clearly a mentalist,[3] the Mel'čuk case is more complex, as IM proposes criteria for defining syntactic structure. But we suspect that these criteria were determined a posteriori and have little influence on the choices of representation of syntactic structure made by IM, as we will show in the following. Let us start with the question of the choice of a dependency tree as a formalism for representing the syntactic structure.

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[2] See the very extensive article on *Inductivism* on Wikipedia.

[3] Let us recall the first words of Tesnière (1959[2015]: chapter 1): "Each word in a sentence is not isolated as it is in the dictionary. The mind perceives connection between a word and its neighbors. The totality of these connections forms the scaffold of the sentence."

In Mel'čuk (1988), it is said that "there are two diametrically opposed methods of describing the syntactic structure of natural sentences: dependency (D-) trees and (PS-) phrase-structure trees" (p.13), which excludes that the syntactic structure could be something else than a tree.[4] IM "claim[s] that dependencies are much better suited to the description of syntactic structure (of whatever nature) than constituency is." This claim is not really argued for and it is just shown in the rest of the book that the formalism suits well. In some sense, IM is honest with that and says at the beginning that "all I intend to do is to suggest an artificial formal language, or a formalism, for describing natural sentences at the syntactic level." (p. 12)

The main arguments proposed by IM for favoring D-trees on PS-trees are the fact that:

- "the D-approach concentrates on the relationships between ultimate syntactic units. i.e. wordforms",
- "a D-tree allows for a natural representation of groupings as well",
- and"a "pure" PS-tree does not allow for a natural representation of relations between wordforms." (p. 14)

There is a presupposition in IM's argument that relations between wordforms should be privileged over relations between any other kind of units, which is not self-evident. If we take the following sentence (1), is it really most natural to express the subject relation as a relation between two words (*compound – creates* according to IM's choices)?

(1) *Watch as the chemical compound creates a colorful glow.* [GUM_whow_glowstick][5]

We prefer to say that the subject of *creates* is *the chemical compound* and if we really want to reduce the relation to a single word, as we will see in section 4, choosing between *the* or *compound* is far from obvious, because neither *compound creates* nor *the creates* is felicitous.[6] We can prefer to say that the verbs is above all linked to *the compound*, without necessarily reducing the relation to a single wordform.

IM does not mention another difference between the two formalisms, D-tree and PS-tree, that we think is more important. We believe that the main difference between the formalisms is what one formalism forces us to tell without the other doing so (Kahane & Mazziotta 2015). In (1), the verb *creates* has a subject, *the chemical compound*, and an object, *a colorful glow*. Which can be easily told by a D-tree.[7] But a PS-tree cannot tell only that. It must necessarily tell in what order the subject and object combine with the verb. In the PS-tree tradition, the verb is considered to combine with its object, forming the constituent has a theme, and then this constituent combines with the subject. In other words, the structure must be stratified, each combination of a constituent with one of its dependents

[4] Many non-tree-based representation have been proposed for the syntactic structure (see for instance Mazziotta & Kahane 2017). Even Tesnière's (1959) stemma is not a pure dependency tree.

[5] Our examples, when they are attested, are extracted from the Universal Dependencies Treebanks of English and French, available on universaldependencies.org and requestable on match.grew.fr (Guillaume 2021).

[6] In English, we can think that the combination with the noun is better than the combination with the determiner, but in other languages, such as French, the noun can never be used without a determiner in the subject position. Even in English, for many combinations, the determiner is more felicitous than the noun:

(i) a. *This blue lipstick is definitely old*. [GUM_vlog_lipstick]
b. *This is definitely old.*
c. ??*Lipstick is definitely old*.

[7] The fact that the verb is linked to only one word of the subject, whatever this word is, is irrelevant. The subject is the projection of the word that is linked to *creates* by the subject relation, that is the whole phrase *the chemical compound*. The choice of one contact word indicates something else, that will be discussed in Section 2.

belonging to a different stratum (Kahane 1997).[8] It is far from certain that this information is relevant and one may therefore prefer, as in D-trees, not to stratify the structure.

On the other hand, D-trees force us to decide, for each combination of two words, which word governs the other. If we take the example (1), we have to decide, for the combination between *the* and *compound* or between *a* and *glow*, if one word governs the other. The formalism forces us to make such a decision, even if it is not relevant.

In an inductive approach, we prefer to first ask ourselves the question of what we want to express before choosing a formalism. Which units are involved in combinations? Do the combinations have to be stratified? Does a combination always link a governor to a dependent? And it is only after having answered these questions that one can make the choice of a representation formalism. It is not the formalism that should impose the choices to be made. There is nothing inescapable here, there are formalisms that allow us to not impose any irrelevant choices on ourselves (see for example, the polygraphs proposed in Kahane & Mazziotta 2015).

2. Criteria for the head of a phrase

As we have said in the previous section, IM assumes that the syntactic structure is a dependency tree. It proposes three types of criteria to define the structure of an utterance:

- Criteria A allow to decide which elements combine and form a phrase;
- Criteria B allow to decide which word is the head of a given phrase;
- Criteria C allow to categorize the constructions and to label the dependencies accordingly.

We will focus only on Criteria B in this article (see Kahane & Gerdes 2022, Chapter 9, for a thorough discussion of Criteria A).

The notion of head of a syntactic unit U relies mainly on the notion of SS-passive valence (or distribution) defined as follows:

> The list of constructions of [the language] L, or more precisely, the list of the surface-syntactic roles in which U can appear either as a dependent component or as an absolute head (i.e., an element that is dependent on nothing) will be called the passive surface-syntactic valency of U. (Mel'čuk 1988: 112)

In other words, the passive valency of U is the list of positions that U can occupy, a position being characterized by its governor and the syntactic relation between this governor and the position.

IM states the criteria for determining the head of a unit U in the particular case where U is the combination of two wordforms w1 and w2, starting with the following criterion:[9]

> **Criterion B.1** (imposition of passive SS-valencies). The SS-head of the phrase w1-w2 is the wordform that determines the passive SS-valency of the phrase to a greater degree than the wordform. (Mel'čuk 1988: 132)

[8] We assume a binary PS-tree, where constituents combine two by two. There is of course the possibility of making a ternary tree, where the three constituents, the verb, its subject, and its object, combine directly together. But if we do that, then we lose a fundamental piece of information, which is that the verb combines with its subject and its object, but the subject and the object do not combine with each other.

[9] One can easily generalize the following criteria to cases where w1 and w2 are any units. In the following, we will propose new versions of the principles of Mel'čuk (1988) by keeping the notations of IM.

The application of this criterion supposes that one can The application of this criterion supposes that one can sufficiently isolate each element of U to determine its own passive valence and thus its contribution to the global passive valence of U. Without questioning the relevance of this definition, let us note at once that the computation of the passive SS-valency is difficult to implement as soon as some elements of U are indistinguishable from each other. An additional principle is therefore necessary, which Mel'čuk (1988:133) states as follows:

> In several cases, one of two wordforms, for example w1, can never be used alone (that is, without w2) as a dependent element in syntactic roles where the whole phrase w1-w2 appears. In such a case, the passive SS-valency of w1 is that of the phrase w1-w2, on the condition, however, that the latter is different from [the passive SS valency of w2].

In fact, this principle is equivalent to introducing a second criterion in the case where the head cannot be isolated from one of its dependents. We propose a variant of the previous principle which we call the Negative criterion with removal. More precisely, if w2 can be used without w1, then the passive valence of w2 can be considered and compared with the passive valence of w1-w2 and we have the following criterion:

> **Negative distributional criterion with removal.** If w2 can be used alone, the more the passive SS-valency of w2 is different from the passive SS-valency of w1-w2, the more w1 is likely to be the head of w1-w2.

The criterion B.1 of IM can then be reformulated in a form that we call the Positive distributional criterion with removal:

> **Positive distributional criterion with removal.** If w1 can be used alone, the more the passive SS-valency of w1 is close to the passive SS-valency of w1-w2, the more w1 is likely to be the head of w1-w2.

There is still one case that is not considered by IM, which is the one where neither w1 nor w2 can be used alone and where therefore the passive SS-valency of neither w1 nor w2 can be considered. In fact, it is not necessary to consider the passive SS-valencies of w1 or w2 to determine which one of w1 and w2 is the head. What we want to determine is the influence of the positions of w1 and w2 on the distribution of w1-w2, which can be done by unrolling the paradigm of these two words. In other words, w1 is the head of w1-w2 if the commutations on w1 change the passive SS-valency of w1-w2 more than the commutations on w2. We call this criterion the Distributional criterion without removal:[10]

> **Distributional criterion without removal.** For every w1' commuting with w1, we can consider the passive SS-valency of w1'. The more the passive SS-valencies of all the w1'-w2 are different from the passive SS-valency of w1-w2, the more w1 is likely to be the head of w2.

IM considers a second criterion for determining the head which is in fact a special case of the Distributional criterion without removal:

> Criterion B.2 (morphological contact point). The SS-head of the sentence w1-w2 is the wordform whose morphological links with sentence's external context are more important than those of the other wordform (that is, the SS-head is the wordform that constitutes the morphological contact point of the sentence). (Mel'čuk 1988:135)

[10] The Distributional criterion without removal was first stated by Garde (1977:8). For Garde, B is the head of AB if "in a given context, A can be replaced by something else, whereas B cannot", that is, commutations on A does not change the distribution, while change on B does.

Let us prove that Criterion B.2 is a particular case of the Distributional criterion without removal. If w1 is the morphological contact point of the sentence, then w1 is an inflected form of a lexeme L and another form w1' of L can also be combined with w2 and the passive SS-valency of w1'-w2 is different from the passive SS-valency of w1-w2. According to the Distributional criterion without removal, w1 is likely to be the head of the sentence w1-w2.

We will now study some cases and see that some decisions taken by IM are not in accordance with the criteria he has stated.

3. The case of relative pronouns

IM considers the head of a relative proposition to be the main verb of that proposition (see especially Kahane & Mel'čuk 1999 for a detailed study of extractions). It firmly rejects the hypothesis that the relative pronoun can be the head of the relative proposition or that the relative pronoun can occupy two positions in the relative, as proposed by Tesnière (1959) or Kahane (2002):[11]

> the relative pronoun depends syntactically only on the main verb of the relative clause. (Mel'čuk 1988:26)

Yet the distributional criteria proposed by IM very clearly give the relative pronoun as head. Consider:

(2) *You can also sometimes find someone **who owns** a pet snake*. [GUM_whow_mice]

We are interested here in the w1-w2 phrase with w1 = *who* and w2 = *owns*. We are familiar with the passive SS-valency of a verb like *owns*, which is the same as that of the proposition U = *she owns a pet snake*. U can be a sentence (and not have a governor) or depend on a subordinating conjunction (*I think that* U). And U cannot modify a noun like a relative clause (**you can also find someone* U). Conversely, a relative cannot be a sentence or depend on a subordinating conjunction. The passive SS-valency of w1-w2 is therefore very different from the passive SS-valency of w2. If we apply criterion B.1 and its additional principle, it is without doubt w1 = *who* that is the head of the relative clause: indeed, the passive SS-valency of w2 (the verb *owns*) is very different from the passive SS-valency of w1-w2 (the relative clause) and since w1 cannot be isolated, w1 has the passive valency of w1-w2 and is the head of w1-w2 (additional principle or Negative distributional criterion with removal). The principles we propose, and in particular the Distributional criterion without removal, confirm this decision, since commuting w1 = *who* with w1' = *she* totally modifies the distribution. It remains that the relative pronoun *who* also saturates the subject position of the verb, which justifies assigning it the role of subject within the proposition. But this cannot exclude that it is the distributional head of the relative clause.

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[11] Let us quote Tesnière (1959[2015]: chapter 246):

> Take for example the pronoun in the French sentence: *l'homme qui écrit* 'the man who writes'. The pronoun *qui* is a translative of the transferred clause the verb of which is *écrit*, because it transfers this clause to an adjective subordinate to *l'homme*. It is also the first actant of the same verb *écrit*, since as an anaphor it represents the word *homme* and is therefore the first actant of *écrit*. Yet all evidence suggests that the stemma – if it is to be a trustworthy representation of the sentence – cannot position a word in two positions if that word appears only once in the sentence in question. The relative pronoun is hence a word that has a **double nature**. It is composed of two syntactic element that fall together, whereby the syntactic analysis reveals that these elements are in fact distinct. Each of these two syntactic elements occupies one of the two positions in the stemma.

4. The case of determiners

Consider the question of the head of a substantive phrase like *the chemical compound* or *a colorful glow* in (1).[12] There is a substantial literature on the question of which of the determiner or the noun is the head of such a phrase (Hudson 1984:90, Hudson 2004, Abney 1987, Osborne 2021).

IM has consistently argued that the noun is the governor of the determiner, not the other way around. This choice is not properly argued by IM. Mel'čuk (1988:112) gives, just after the definition of the passive SS-valency, a first example which is that of the noun in English, identifying it with the "noun phrase" (that is, the substantive phrase in our terms). This example seems to us to be particularly poorly chosen, since in many cases the noun cannot be isolated from the determiner and thus it is not possible to determine its passive SS-valency. IM states that the passive SS-valency of the English noun is to be able to occupy the positions of subject, object, complement of a preposition, etc., but these are positions where the noun must be used with a determiner.[13] But this is the passive valence of a substantival group, and to decide whether it is the passive valence of the noun or of the determiner, we should have already decided which one governs the other.

Let's take the case of French, where IM makes exactly the same analysis. (For English, see Hudson's work.) In French, the noun is never used without a determiner in the subject position and in many other positions.

(3) a. *Le cheval court.* 'The horse runs.'

b. **Cheval court.*

A position like the subject position belongs to the passive valence of the determiner-noun phrase, i.e. of a substantival group, but it cannot be said to belong to the passive valence of the noun. On the other hand, there are positions where a noun is used without a determiner and where the addition of a determiner is forbidden:[14]

(4) a. *Cet exemple a pour* (*DET) *principal avantage d' être simple.*
This example has for main advantage to be simple.
'The main advantage of this example is that it is simple.'

b. *Sauf* (*DET) *réponse rapide de votre part, …*
'Unless (I get a) quick answer from you, …'

c. *Nous parlons* (*DET) *syntaxe*.
We talk syntax.
'We are talking about syntax.'

These constructions (*avoir pour* N; *sauf* N; *parler* N) belong to the passive valence of the noun and not to that of the noun. These examples show that the passive valence of the noun is different from that of the substantive phrase.

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[12] We purposely use the term substantive phrase, rather than the traditional term noun phrase (which presupposes that the head is a noun) or determiner phrase. Personal pronouns, such as *she* or *it*, or proper nouns such as *Mary* or *London*, are substantives and form substantive phrases on their own.

[13] The case of English is a bit complicated, because the plural countable noun and the massive noun are used alone in the indefinite phrase. Nevertheless, this absence of a determiner is significant. It is not like the absence of the modifier *big* with *houses* (as opposed to *big houses*), which does not allow us to decide if the houses are big or not; the absence of a determiner in these positions means that the phrase is indefinite. We can therefore consider that the determiner is compulsory in English.

[14] We eliminate of course the case of idiomatic expressions where the noun can no longer be modified or commuted with another noun. In the three constructions considered, the noun paradigm can be rolled down quite freely.

On the other hand, there are no positions, as far as we know, where a determiner can be used alone but could not be accompanied by a noun. For example, in subject position, some determiners can be used alone (they have a pronominal value), but the addition of a noun is of course possible:

(5) a. *Plusieurs sont venus.* 'Several came.'

b. *Plusieurs amis sont venus.* 'Several friends came.'

The normal conclusion, according to criterion B.1, would be to conclude that the determiner is the head of the substantive phrase and governs the noun.

5. The case of coordinating conjunctions

IM was one of the first to introduce an asymmetric analysis of coordination, showing that the second conjunct forms a phrase with the coordinating conjunction and that this phrase is added to the first conjunct.[15] Thus in (7a), the second conjunct, *Mary*, can form a speech turn with the coordinating conjunction (7b), while the first conjunct cannot (**Peter and*).

(6) a. *Peter and Mary*

b. Spk1: *We invited Peter*. Spk2: *And Mary*.

The question now is to decide which of the second conjunct or the coordinating conjunction is the head of the adjunct phrase. For IM, the answer requires no discussion:

> within the conjunction phrase itself, the conjunct introduced by the conjunction depends on it (since it is the conjunction that determines the passive syntactic valency, or distribution, of the conjunction phrase). (Mel'čuk 1988:27)

The issue seems rather tricky to us, though, since syntagms like *and Mary*, *and blue*, *and now*, or *and went out* have different distributions. On the other hand, *Mary* and *and Mary* also have different distributions, since *and Mary* cannot be subject or object of a verb.

Following the additional principle stated by IM after criterion B.1, since *and* cannot be used alone and *and Mary* and *Mary* do not have the same passive SS-valency, then the passive SS-valency of *and* is that of *and Mary*. We must conclude that *and* is the head of *and Mary*. But the same reasoning leads us to say that the passive SS-valency of *and* is also that of *and blue*, *and now*, and *and went out*, which is absurd, since all these phrases have different distributions. We can thus see that the additional principle to criterion B.1 does not work and that it is preferable to stick to the principles we have proposed, the Negative distributional criterion with erasing and the Distributional criterion without erasing.

We are clearly in a situation where both elements, the coordinating conjunction and the conjunct, have head properties. If we do not want to give up having a dependency tree, we can try to take the least bad decision and thus ask ourselves the following question: is the distribution of *and Mary* more different from that of *and blue* or that of *Mary*? Note that *and Mary* and *and blue* can never commute, while *Mary* can commute with *and Mary* in at least two situations. First, in a coordination, it is possible that the second conjunct be not introduced by a coordinating conjunction (7a,b). This is even common in a list (7c,d).

[15] This analysis is reversed for languages with a final head such as Japanese, Korean, or Beja (Kanayama et al. 2018, Kahane et al. 2021). In these languages, the coordinating conjunction forms a phrase with the first conjunct and adds on the second conjunct.

(7) a. *Scientists analyze effects of global warming, atmospheric ozone on crops*. [GUM_news_warming]

b. *The wind whips her hair, ruffles the skirt around her knees*. [GUM_fiction_falling]

c. *The land, the natural resources, the markets, all these go together*. [GUM_interview_peres]

d. *donc, on voit, on le voit sortir, euh, du pain, des brioches, des trucs comme ça*. [Rhap_M0023] 'so, we see, we see him taking out, uh, bread, buns, stuff like that.'

Secondly, it is possible that the two conjuncts of a coordination are introduced by a coordinating conjunction. This is for example common in French with the disjunction in *soit* A, *soit* B 'either A, or B':

(8) *Il peut être livré **soit** conditionné en sacs de 50 kg ou 500 kg, **soit** en vrac*. [GSD]
'It can be delivered **either** packed in 50 kg or 500 kg bags, **or** in bulk.'

In this case, we are forced to conclude that the passive valence of the first layer of the coordination (i.e. *soit* A) is determined by the passive valence of A alone. Taking conjuncts A and B as heads of both layers of the coordination also has the advantage of having a parallel analysis of the two layers.

In conclusion, nothing allows us to conclude with evidence that the coordinating conjunction is the head of the conjunction phrase and several elements show that there is an advantage in choosing the conjunct as the head and making the coordinating conjunction a dependent of the conjunct.

Conclusion

We have shown that for at least three of the most common constructions in the language, the syntactic structures that Igor Mel'čuk defends contradict the criteria he proposes. From there, one can either question the proposed analyses or question the criteria. All indications are that IM would prefer to modify the criteria. This remark made in Mel'čuk (1988:138) is quite revealing:

> However, I am not completely convinced that Criteria B.1 and B.2 never contradict the researcher's intuition regarding the direction of syntactic dependencies. There may be constructions whose SS-heads are obvious from the viewpoint of linguistic intuition, but not treated as such by these two criteria. In this sense, logical sufficiency of Criteria B.1 and B.2 is postulated but not guaranteed.

On our side, we defend an inductive approach to syntactic structure. The definition of syntactic structure should not precede the study of the data: it is the properties of the data that determine the syntactic structure in a language model.[16] In other words, one must first decide which properties are essential to the modeling of the language and then determine the different structures that are relevant to define in order to model the functioning of linguistic data.[17] We believe that this is the case of distributional criteria which allow

[16] Behind this difference in viewpoint there is also a difference in the value we attribute to syntactic structure. Several personal discussions we have had with IM lead us to believe that he gives a cognitive value to the dependency tree, that he postulates that it is really part of the functioning of the language in the speaker's brain. Without necessarily questioning the existence of syntactic constraints in the speaker's brain, we do not think that these can be reduced to a structure as elementary as a dependency tree. The dependency tree is indeed for us an object of the linguistic model, simple enough to make this model understandable to a linguist or anyone interested in language (and especially to learners) (Osborne 2019).

[17] In practice, things are done with constant back and forth between the properties of the data and the structures considered. The intuition of a dependency structure has largely preceded in the history of linguistics the demonstration of properties such as the distributional criteria considered in this article. The distributional approach developed from Bloomfield (1933) and the first criteria for defining a dependency structure date back to Garde (1977), while dependency analyses can be found since antiquity (Imrényi & Mazziotta 2019).

to explain the functioning of the combination between units: when a speaker combines two units, only units which play a role in the distribution of the resulting phrase need to be kept for the rest of the computation. There is usually only one word that plays a role in the distribution of the phrase, but there are some constructions where two words must be retained. This is the case, in our opinion, for the constructions we have studied: determiner-noun, relative pronoun-verb and coordinating conjunction-conjunct. For a more in-depth development of an inductive approach to the development of a syntactic structure in dependency syntax, one can consult Gerdes & Kahane (2013) and Kahane & Gerdes (2022).

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