

## POSSIBLE ROLES FOR SEMANTICS AND SYNTAX IN A GOVERNMENT-BINDING STRUCTURE

### ROLES POSIBLES PARA LA SEMÁNTICA Y LA SINTAXIS EN UNA ESTRUCTURA DE RECCIÓN Y LIGAMIENTO

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#### ABSTRACT

As described, for example, by Hornstein, the general linguistic framework given by the contemporary government-binding theory distinguishes several levels. This paper is intended to show that a differentiation of that kind, if such levels are understood in a different manner, can be clearly consistent with some developments in current cognitive science, and, in particular, with approaches such as the one of López-Astorga, which attempts to link proposals that, in principle, can be deemed as irreconcilable, such as the mental models theory and the idea that human cognition is led by logical forms. In this way, without accepting the characteristics that usually are assigned to the levels pointed out by the government-binding theory, it is argued that the role attributed to semantics and syntax by López-Astorga can be compatible with a general structure more or less akin to the one of this last theory.

Keywords: government-binding theory; logical form; mental model

#### RESUMEN

Como lo describe, por ejemplo, Hornstein, el marco teórico lingüístico general ofrecido por la teoría contemporánea de rección y ligamiento distingue varios niveles. La intención de este trabajo es mostrar que una diferenciación de este tipo, si tales niveles se comprenden de una manera diferente, puede ser claramente consistente con algunos desarrollos de la ciencia cognitiva en la actualidad, y, en concreto, con enfoques como el de López-Astorga, que trata de vincular propuestas que, en principio, pueden ser consideradas como irreconcilables, como, por ejemplo, la teoría de los modelos mentales y la idea de que la cognición humana es guiada por formas lógicas. De este modo, sin aceptar las características que usualmente se asignan a los niveles señalados por la teoría de rección y ligamiento, se argumenta que el rol atribuido a la semántica y a la sintaxis por López-Astorga puede ser compatible con una estructura general más o menos semejante a la de esta última teoría.

Palabras claves: Teoría de la rección y el ligamiento; forma lógica; modelo mental

## Introduction

It can be said that the government-binding theory, which is described in different works (e.g., Hornstein, 1995; Chomsky, 1981), is a contemporary linguistic theoretical framework proposed to explain the phenomenon of communication. It is true that some of the writers that comment on it at present do not really accept this approach (e.g., Hornstein, 1995, moves forward towards minimalism). However, this paper tries to show that the pieces of evidence offered by certain results and arguments in current cognitive science and philosophy of language seem to make it evident that, indeed, the government-binding theory, as explained in works such as the one of Hornstein (1995), speaks about levels that, if they are reinterpreted and redefined, match real communicative mental processes.

In particular, of course, with nuances, changes, and modifications, it appears that such levels can be, in principle, linked to proposals such as, for example, the one of López-Astorga (2017). Approaches such as this last one try to relate basically semantic frameworks rejecting logical forms to much more syntactic theses tending to lend primacy to the formal aspects in thought and in cognition. Thus, this more or less direct relationship between the government-binding theory and proposals such as the one indicated can lead one to think that, certainly, at least the general structure of that linguistic theory still deserves to be considered.

All of this will be shown in this paper. In this way, the chief task will be to resignify the different linguistic levels distinguished by the government-binding theory explaining at once how those resignified levels can be clearly linked to cognitive processes such as the ones described in proposals such as the general one of López-Astorga. The original levels of the theory, as Hornstein (1995) indicates, are ‘Deep Structure’ or ‘D-Structure’, ‘S-Structure’ (which will be named ‘Semantic Structure’ here), ‘Logical Form’, and ‘Phonetic Form’. Then, each of these levels will be addressed in turn indicating, at the same time, how they could be reinterpreted from accounts such as the one of López-Astorga (2017).

## Deep Structure

Given that what will be offered here is, as said, a reinterpretation of the linguistic levels of the government-binding theory under López-Astorga’s (2017) framework, it is obvious that this first level, as well as the other three, will be deemed below neither as they are actually understood in the government-binding theory nor as Hornstein explains them. And this is so because the point of this paper is just to show that a formal or general structure of communication such as that proposed by that theory can continue to be suitable to account for the actual levels involved in the production of linguistic messages.

Having said that, it can be claimed that the manner Deep Structure will be considered here is as the level in which all the definitions corresponding to the language that is being used are. In other words, the level where linguistic general knowledge is contained. In this way, in the next sections the existence of a hypothetical speaker knowing a number of concepts and definitions will be assumed. Such concepts and definitions are the following:

‘Novel’: literary work. Usually, a book telling a story.

‘Don Quixote’: a particular novel originally written in Spanish and telling the particular story of a particular character: Don Quixote of La Mancha.

‘Soda’: carbonated water.

‘Beer’: alcoholic beverage.

‘Fridge’: household appliances to keep food and beverages cold.

Of course, a hypothetical speaker such as the one that will be assumed here, if he/she knows the previous concepts and definitions, he/she should also know much more concepts and definitions (clearly, e.g., if he/she knows what ‘Don Quixote’ means, he/she should also possess some general education) and, likewise, he/she can know more details about those five expressions too (e.g., he/she can know that Don Quixote was written by Miguel de Cervantes Saavedra). Nevertheless, the expressions indicated and the short definitions assigned to them above suffice to make the point of this paper and build the arguments necessary to achieve its aim. So, the next section continues with the following level of the government-binding theory.

## S-Structure

Actually, the government-binding theory “organizes the grammar in a ‘T-model’” (Hornstein, 1995, p. 3; quotation marks in the text) in a manner akin to that of Chomsky and Lasnik (1977). At least, this is what Hornstein points out in Note 2 of Chapter 1 of his book mentioned above (Hornstein, 1995, p. 203). Nonetheless, as stated in the previous section, the levels of the theory are not being taken here in its original sense. Thus, trying to adapt those levels to López-Astorga’s (2017) theses, S-Structure will be named in this paper ‘Semantic Structure’, and this for a clear reason: beyond the fact that accounts such as the one of the extended standard theory, which can be considered to be a forerunner of the government-binding theory, attribute to this level a greater influence on the semantic aspects (Hornstein, 1995), it will be described here with the help of a cognitive semantic approach: the mental models theory (e.g., Khemlani, Hinterecker, & Johnson-Laird, 2017).

If the literature on this last approach is reviewed, it can be noted that the mental models theory actually deals with the processes of reception of information, since what is interesting for it is mainly how individuals reason from the sentences included in the messages they receive (see, e.g., Oakhill & Garnham, 1966). However, because, in a previous work in which López-Astorga (2015) describes his proposal as well, he speaks about two cognitive phases and relates the first one to the mental models theory, and hence to semantics (and the second one to syntax and the detection of logical form), it can be thought that, under López-Astorga’s framework, the reverse process (i.e., the process by means of which the messages are built by a speaker) can also be accounted for by resorting to a first phase where the activity is semantic and akin to the one described by the mental models theory.

In this way, it can be supposed that the step from Deep Structure to Semantic Structure can be made in the manner as the mental models theory provides, that is, by constructing models or representations that stand for reality in an iconic way (e.g., Johnson-Laird, 2012; Johnson-Laird, Khemlani, & Goodwin, 2015). Nevertheless, actually, the models or representations are possibilities and individuals tend to think about the different iconic possibilities that can be admitted between concepts, definitions, ideas, or facts (e.g., Khemlani, 2017). Thus, if the two first expressions in the previous sections (i.e., ‘novel’ and ‘Don Quixote’) are taken into account and it is known, for example, that a woman called Eva reads a novel, only two iconic representations are possible (this example of ‘Eva’, ‘novel’, and ‘Don Quixote’ is to be found in several works of the literature on cognitive science; two of them, in which there are explanations similar to the one of this paper, are, e.g., Khemlani, Byrne, & Johnson-Laird, 2018, and Orenes & Johnson-Laird, 2012):

[I] (Eva reads a novel) & (she reads Don Quixote)

[II] (Eva reads a novel) & (she does not read Don Quixote)

The other two combinations are not possible. The scenario in which Eva does not read a novel and she reads Don Quixote is not possible because, as said, our hypothetical speaker knows that Don Quixote is a novel, and, if it is read, a novel is also necessarily read, and this apart from the fact that the speaker, as also indicated, already knows for sure that Eva, indeed, reads a novel. In this way, the remaining combination is not possible either. It provides that neither Eva reads a novel nor she reads Don Quixote, and, as just mentioned, it is known that she does read a novel.

This selection of possibilities is made, according to the mental models theory, by virtue of the action of modulation (e.g., Johnson-Laird & Byrne, 2002; Quelhas & Johnson-Laird, 2017; Quelhas, Johnson-Laird, & Juhos, 2010). Modulation acts resorting to the meaning of expressions and circumstances (i.e., semantic and pragmatic criteria). Nonetheless, its action is not always obvious. In the previous case, it is clear because the speaker knows that Don Quixote is undoubtedly a novel and, therefore, as indicated, it cannot be read without reading a novel. But, if the other three expressions in the previous section (i.e., ‘soda’, ‘beer’, and ‘fridge’) are considered, and it is assumed that there is something to drink, either soda or beer, for sure in the fridge, the options are really three (this example and similar accounts to the one of this paper for it are to be found in the literature too; see, e.g., Khemlani, 2018):

[III] (the fridge contains soda) & (it contains beer)

[IV] (the fridge contains soda) & (it does not contain beer)

[V] (the fridge does not contain soda) & (it contains beer)

Evidently, the only combination that is not possible here is that in which there is nothing (neither soda nor beer) in the fridge, and this is so just because, as also said, it is a priori known that there is at least something to drink in it. So, the action of modulation is not as clear in this case. However, perhaps what is more important now is that, on the one hand, [I] and [II] and, on the other hand, [III], [IV], and [V] offer different possible situations describing the world, and that, from them, it is possible to come to both logical forms and phonetic forms. This is relevant because the next step in the government-binding theory actually branches to two separate and without connection directions: Logical Form and Phonetic Form. Indeed, as commented on by Hornstein (1995), D-Structure leads to S-Structure, but S-Structure can follow the two directions mentioned.

Strictly speaking, one might think that what the mental models theory would truly claim is that there would be only one direction from Semantic Structure: Phonetic Form. This is so because this last theory clearly rejects logical forms (e.g., Johnson-Laird, 2010) and proposes that reasoning occurs directly from iconic descriptions such as [I], [II], [III], [IV], and [V], without relationship to formal or syntactic structures. Nevertheless, what is being considered here is not the original framework of the mental models theory, but López-Astorga’s proposal, which makes it coherent with syntax, and hence, as this paper tries to argue, with a general structure similar to that of the government-binding theory. Then, these last points are addressed.

## Logical Form

Obviously, and as already pointed out as well, the logical forms that are going to be taken into account in this section do not have the same characteristics as they have in works such as that of Hornstein (1995). In those works, they are more related to semantics and the final interpretation of the expressions. Nevertheless, in this paper, following studies such as, for example, those of López-Astorga (2015, 2017), the logical forms that will be linked to the models of the mental models theory are logical forms more syntactic and akin to the ones of classical logic. This can be relevant because there are also theories stating the existence of a syntax corresponding to the intellectual activity (e.g., the framework presented in works such as the one of Braine & O’Brien, 1998). Nonetheless, these theories sometimes refer to logical forms that do not always fulfill all the requirements of standard propositional calculus. That is not the case in López-Astorga’s approach, since its logical forms are, as indicated, similar to well-formed formulae in classical logic.

Thus, what is proposed in texts such as those of López-Astorga (2015, 2017) is to deem models such as [I], [II], [III], [IV], and [V] as rows in a logical truth table. In this way, given these equivalences:

p: Eva reads a novel

q: Eva reads Don Quixote

[I] and [II] can lead to a truth table corresponding to a formula that is true whenever p is so, and in which q can be both true and false. As indicated, for example, in López-Astorga (2015), some formulae fulfilling those requirements can be:

[VI]  $(p \vee \neg p) \rightarrow q$

(Where ‘ $\vee$ ’ represents disjunction, ‘ $\neg$ ’ is negation, and ‘ $\rightarrow$ ’ stands for the conditional).

[VII] q

Indeed, both [VI] and [VII] can be suitable logical forms for the set consisting of [I] and [II]. However, [III], [IV], and [V] can also lead to a logical form. If the equivalences are now as follows:

p: The fridge contains soda

q: The fridge contains beer

They reveal that their formula should be such as to be false in a truth table only when both p and q are false. Again, in, for example, López-Astorga (2015), it is explained which that formula could be:

[VIII]  $p \vee q$

In this way, as López-Astorga raises, it is possible to find logical forms consistent with the semantic representations of the mental models theory. Thus, following him, although this last theory is right and what is deemed as Logical Form here is not necessary for reasoning, one cannot ignore that there are really syntactic structures that can be undoubtedly linked to models such as those that in this paper have been positioned in Semantic Structure, and, accordingly, that, against the original theses of the mental models theory, the relationship between semantics and syntax is unquestionable.

## Phonetic Form

Nevertheless, it is also clear that the representations attributed to Semantic Structure above can lead to phonetic forms (which, as it can be checked below, will be actually understood here as expressions in natural language) as well. If [I] and [II] are taken into account again, it can be said that several phonetic forms are possible. One of them can be, for example,

[IX] Whether or not Eva reads Don Quixote, she reads a novel.

Another option can be, as done, for instance, by Khemlani (2018), to use a disjunction:

[X] “...Eva read Don Quixote or a novel” (Khemlani, 2018: 1899).

Certainly, beyond the fact that the grammatical tense in [X] is passed, there is no doubt that its phonetic form can be a possibility for [I] and [II] too. Furthermore, as far as [III], [IV], and [V] are concerned, it is evident that disjunction is also a possibility to easily consider:

[XI] “There is soda or beer in the fridge, or both” (Khemlani, 2018: 1901).

Undoubtedly, more phonetic forms for both, on the one hand, [I] and [II] and, on the other hand, [III], [IV], and [V] can be built and proposed in English. Nonetheless, at this point, maybe it is important to make it explicit that Semantic Structure, following the account described in this paper, does not really consist of models with words and expressions in English or in any other language. Those models, as

stated, are really iconic and, therefore, can lead to phonetic forms in different languages. Just some examples in Spanish, French, and Portuguese can be the following:

[IX].b (Spanish): Lea o no lea Eva Don Quijote, lee una novela.

[IX].c (French): Que Eva lise ou non Don Quichotte, elle lit un roman.

[IX].d (Portuguese): Quer ou não Eva lê Don Quixote, ela lê um romance.

[X].b (Spanish): Eva leyó Don Quijote o una novela.

[X].c (French): Eva a lu Don Quichotte ou un roman.

[X].d (Portuguese): Eva leu Don Quixote ou um romance.

[XI].b (Spanish): Hay soda o cerveza en el refrigerador, o ambas.

[XI].c (French): Il a du soda ou de la bière dans le réfrigérateur, ou les deux.

[XI].d (Portuguese): Há refrigerante ou cerveja na geladeira, ou ambos.

But perhaps what is even more relevant here is the fact that, whatever the final Phonetic Form and whatever the language it is expressed, it directly comes from, as indicated, Semantic Structure, with, in principle, no relationship to Logical Form. This clearly allows deriving very interesting consequences and conclusions.

## Conclusions

Indeed, if that is so, mental processes can be truly as described by the mental models theory. People do not pay attention to or take logical forms into account when making inferences. As commented on, the step from Semantic Structure to Phonetic Form is not through Logical Form. So, this last element is not absolutely necessary in reasoning.

It is true, and that has been said above too, that what has been presented here is not a rigorous description of the mental models theory, but only an interpretation of it, the one given in works such as, for example, those of López-Astorga (2015, 2017), and which links it to syntax, in order to show that it can be compatible with a general structure such as the one of the linguistic government-binding theory. Based on that interpretation, this paper has offered an account of the way the processes of linguistic messages production and transmission can be carried out. Furthermore, what the original mental models theory really proposes is, and this has been mentioned as well, an explanation of the inverse process, that is, the process that happens when a listener or reader receives information and thinks about it (in fact, the interpretation of it given in texts such as López-Astorga, 2015, 2017, also mainly addresses this last process). But the point in this regard can be that, as stated too, the mental models theory rejects logical forms in this inverse process as well.

And this can be the point because the explanations above, that is, the adaptation of the general approach given by the government-binding theory to López-Astorga's framework, present a schema in which, as in the original mental models theory, the expressions in natural language (what has been deemed here as Phonetic Form) are not connected to logical forms (what has been deemed here as Logical Form), but just to the iconic models (what as been deemed here as Semantic Structure). Thus, given that the resignification of this paper of the government-binding theory as described by Hornstein (1995) respects what truly occurs in it (both Phonetic Form and Logical Form are connected to S-Structure, but there is no connection between Phonetic Form and Logical Form), it can be claimed that, if reinterpreted, even basic linguistic frameworks can become further pieces of evidence in favor of cognitive theories such as the one of the mental models.

In addition, the presence of Logical Form can be, on the other hand, support to López-Astorga's interpretation. As said, the original mental models theory ignores logical forms and syntax, but, for instance, López-Astorga (2017) raises the idea that, even if this last theory is absolutely right, one can always find logical forms corresponding to its iconic models or, resorting to the terms used in this paper, a Logical Form corresponding to every Semantic Structure. So, as López-Astorga claims, it appears that the link between semantics and syntax cannot be bypassed. And this, as said, even if it is the case that the cognitive reality in human beings is exactly such as the original mental models theory proposes and Logical Form is not usually taken into account. Something may not be taken into account, but this last circumstance does not necessarily imply that it does not linguistically exist.

Finally, one might ask which the role of pragmatics in this framework is exactly. Nonetheless, that question would already be answered. It has been indicated above that the mental models theory assumes that the choice of semantic models does not depend only upon purely syntactic criteria. Pragmatics and circumstances also have an influence on the action of modulation. So, it can be thought that, notwithstanding its name, Semantic Structure is not an absolutely semantic structure, and that pragmatics can be included in it.

What has been presented in this paper is, accordingly, a theory of the communicative event based on the general schema of a linguistic theory such as the one of the government-binding and, in addition, taking the developments of current cognitive science into account. And it is able to integrate semantics, syntax, and even pragmatics. Undoubtedly, a study akin to that carried out here could also be made paying attention to other linguistic proposals, including the minimalist one given by Hornstein. However, for the time being, at the very least, it can be said that an approach linking a general linguistic structure (even if its levels are resignified and reinterpreted) to frameworks coming from cognitive science exists. That is the one described above.

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