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Rozprawa

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I-SEMANTICS: FOUNDATIONAL QUESTIONS[1]

Summary: What is the scope of a semantic theory consistent with the theoretical assumptions adopted by the generative program? In this paper I will show that the linguistic theory generically known as generative grammar is an extremely coherent Scientific Research Program and within this descriptive framework it's possible to characterize the main features of an I-semantics. First, will be presented the hardcore of the generative program, its heuristics and Chomsky's criticism towards formal semantics. Second, I will compare two approaches: the denotational approach by Larson and Segal and the intensional approach by Paul Pietroski. I argue in favor of Pietroski's approach, because it is more coherent with the core assumptions of the generative program. The main argument is that syntax, in the context of the generative program is explanatory and, in this very context, semantics is not. Therefore, in order to account for the explanatory role of syntax in the generative program it is necessary to review certain foundational assumptions commonly accepted in formal semantics.

Keywords: syntax – semantics interface, generativism, philosophy of linguistics.

1. INTRODUCTION

This paper attempts to answer the following problem: What is the relationship between the notion of an internalized linguistic competence, as conceived by the generative program, and a semantic theory?

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More specifically, what is the scope of a semantic theory consistent with the theoretical assumptions adopted by the generative program? Section 2 introduces descriptive concepts to characterize the generative program, Lakato's Methodology of Research Programs. In 2.1, I characterize the hardcore of the generative program. In 2.2, I introduce the methodological foundations of the generative program. Section 3 presents Chomsky's criticisms against extensional semantics. In section 4, I present the extensional approach to I-semantics, proposed by Larson and Seagal. In Section 5, I present the proposal offered by Paul Pietroski. After comparing and contrasting these proposals, I argue in favor of Pietroski's approach, because it is more coherent with the core assumptions of the generative program and it expands the positive heuristics of this research program. The main argument is that syntax, in the context of the generative program is explanatory and, in this context, semantics is not. Therefore, in order to account for the explanatory role of syntax in the generative program it is necessary to review certain foundational assumptions commonly accepted in formal semantics.

2. LAKATOS'S METHODOLOGY

The generative linguistic theory has been presented as a scientific research program (SRP), which requires us to define such term. It was coined by the Hungarian science philosopher Imre Lakatos in 1978. It is related to his notions of the evolution and history of science. To Lakatos, scientific knowledge distinguishes itself from other forms of knowledge because it is structured around a number of untestable propositions (testable as defined by Karl Popper, 1959) that express the basic assumptions on which the theoretical approach is founded. Lakatos named such a set of propositions a hard core. Thus, the hard core is supposedly formed by a set of metaphysical propositions regarded as untestable by methodological decision. Additionally to the hard core, there is the heuristic, a set of methodological procedures that delimit the scientific research according to the program in question. The heuristic selects and organizes the problems and questions to be answered along the research as if it were a work plan, selecting topics for investigation and describing how they will be approached. The heuristic sets the methodological rules that guide empirical research.

The heuristic may be negative if it sets rules that indicate which directions should be avoided in the research and that ban any changes to the hard core of the program (i.e. that control what can be absorbed), or positive if it determines the rules that point towards the directions to be followed, thus controlling the limits beyond which the research can expand. In summary, according to Lakatos, a scientific research program contains a hard core of basic theoretical assumptions, based on which, the approach and even the object of study are defined.

According to Lakatos, a scientific research program progresses as it proposes various theoretical models that are different from each other, because auxiliary hypotheses are formulated during the process of scientific inquiry to handle data as they are collected and adjusted to the model. This is what makes them different from each other. According to Lakatos, having different models should not be a problem, provided that they share a common hard core and heuristic. The advantage in adopting such an approach, and what ensures the success of science in comparison with other types of knowledge, is that new hypotheses replace older ones, and new theoretical propositions originate therefrom.

This does not require one to forgo core objectives and issues. They remain preserved in the hard core and heuristic, which adds flexibility and efficiency to the process of producing scientific knowledge.

In regard to the application of Lakatos's scientific theory to gauge the progress of a theoretical model, there are important points to be made. Firstly, according to Lakatos, if two theories (T1 and T2) are part of a scientific research program, T1 is superior to T2 if T1 has more empirical content, i.e. if it explains more facts that T2, or if T1 has more heuristic power, i.e. if both the facts previously explain by T2 and the new facts explained by T1 receive a more appropriate treatment in terms of descriptive, explicative-predictive, depth and usability potential, as conceived by Ludlow (2011), according to whom the simplicity of a theory is directly linked to the simplicity of its use. In summary, testing a theory is an 'internal' process and is based on its ability to explain more facts in a program, and to do so more efficiently.

Secondly, if T1 is superior to T2, it is evident that there will be a trend to promote T1 to the detriment of T2, which will lead to a number of changes to the heuristic of the program. Such changes

may be of two types: creative changes, which cause the positive heuristic of the program to expand; and degenerative changes, which force changes upon the hard core of the program, or ad hoc changes to the heuristic itself. It is the balance between the quantity and the intensity of each type of change that determines the size and the speed of such alterations, and that provides support for the evaluations. On the other hand, as one might assume, the said evaluations are far less dependent on the subject judgment of the one who conducts them. They are more closely linked to the overall behavior of the program in relation to its developments. Thus, the evaluation of an SRP is performed according to such developments: a program is progressive if its theoretical development predicts its empirical development; or it regressive if its theoretical development is delayed in relation to its empirical development, requiring ad hoc explanations.

Considering Lakatos's propositions as they have been described so far, it is possible to define some parameters to guide a preliminary evaluation. The objects of these evaluations are obviously the components of a scientific research program, namely its hard core and heuristic. From such a perspective, one may ask: what is the hard core and the heuristic of a generative program? What are its characteristics? These questions support the evaluation described in the following sections.

2.1. THE HARD CORE

The hard core of the Generative research program can be summarized in the two following propositions, and a third one can also be added. Without further discussion, I would like to propose that the nucleus of the GG consists of the following statements:

The sentences in a given language are determined, at least in part, by states of the mind/brain, and states can be defined in terms of internalized knowledge of that language, which is rooted in the mental/brain structures of human beings, and it is called I-language:

The nature of these states of mind/brain can be described by theoretical models that represent the computation involved in the generation of the sentences, generating a theory of I-language, which is called grammar (of I-language);

The acquisition and development of internalized knowledge is mostly determined by an innate, biological predisposition, as per

a Universal Grammar.[2] As a branch of cognitive psychology, the generative program has as its object of study the internal cognitive states of the mind/brain of the speaker-listener.[3]

The hard core of a research program is comprised of a set of propositions regarded as untestable, in the Popperian sense, and only assumed. In other words, propositions that are 'metaphysical' and that reveal the point of view that will give the very definition of the object of study, etc. Therefore, one could expect that it cannot be criticized, as the initial assumptions derive from the specific choices made in each research work according to the phenomena it intends to analyze. What generative grammar intends to do is to construct a computing device, capable of forming and transforming representations, that can 'simulate' the linguistic knowledge a speaker of a natural language has in his mind/brain. It is this 'nucleus', constantly present in the history of generative grammar history, that allows us to say we have one and the same research program, in spite of the various deep changes the theoretical device has undergone. The hard core of a generative research program has proved extremely fruitful, as evidenced by the countless relevant research projects that have been conducted on the matter. It is, therefore, at least for the moment, safeguarded from direct attacks against its hard core.

On the other hand, hard-core assumptions must be the only ones that are untestable. Therefore, the other assumptions, the heuristic ones, must be tested and are subject to falsification. The restrictions regarding the number of conjectures and assumptions must be extremely severe, according to what could be considered a 'stricter' interpretation of formal rigor – phenomena must be explained within the boundaries of the hard core and the heuristic. Explanations must strictly fit within the hard core and the heuristic rather than shape them.

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[2] See Chomsky (2005) about the importance of general laws of nature or computation, outiside the cognitive endowment, to the development of the internalised knowledge.

[3] It is worth remembering that the internalism defended by Chomsky is a methodological perspective in linguistics that does not deny the legitimacy of the study of certain aspects of the E-language. He argues that all linguistic theory (i.e. the study of each level of linguistic articulation) should be identified by the study of these aspects. In addition, he 'suspects' the feasibility of a scientific study of E-language without an in-depth study of I-Language.

According to Boeckx (2006) the Minimalist Program (MP) should be considered as part of the model that resulted from the last major elaboration of the program, the Principle and Parameters Theory. MP would consist of methodological guidelines to help linguists to apply 'Ockham's razor' to the Principles and Parameters Theory (P&P), eliminating what was unnecessary. In order to understand the MP role, we must understand better the working hypothesis of human languages proposed by the GG program. According to Chomsky, languages are biological systems that men use to speak about the world: describe, refer to, ask, communicate with one another, articulate thoughts etc. Those 'things' we do with language constitute what Chomsky calls the conceptual intentional system. On the other hand, as an 'expressive' medium, language must be associated with a production and reception system, of motor-sensorial nature, capable of allowing for the production and reception of sounds that constitute the linguistic expressions. Chomsky labels this second system the articulatory-perceptual system. Thus, the human language must be able to contact (be an interface of) not only the conceptual-intentional system (C-I), but also the articulatory-perceptual system (AP).

The spirit of formal rigor seems to have been incorporated more explicitly by Minimalism, since it assumes that all theory constructs that are not required by the theory should be eliminated and that new propositions should be limited to those that are fully explainable within the context of the theory, i.e. those that are empirically motivated according to the theory. Such an explicit statement suggests that the rigor has not always been construed as described or even maintained in previous stages of Generativism, notably in the Principles and Parameters model (Chomsky 1981). However, the commitment of Minimalists to such rigor still represents progress to a certain extent.

2.2 THE HEURISTIC

Analyzing the heuristic of Generativism involves reflecting upon two central questions: what are the methodological rules employed in the generative program and how capable are they of meeting the requirements of the program's hard core? What is the relationship between such rules and the heuristic assumed by the generative program and

how much have they expanded this heuristic? These questions emerge as it becomes evident that, despite the unequivocal achievements of the generative theory as regards our understanding of human language, there is some tension between heuristic matters and the methodological rules they involve. The methodological rules hitherto adopted by classic Generativism force the expansion of the negative heuristic to the detriment of the expansion of the positive heuristic.

2.2.1 POSITIVE HEURISTIC

The Generative Program aims to formulate a model that is capable of explaining the linguistic phenomena. From its very foundation it opposes the taxonomic concept of linguistics, according to which the purpose of language sciences is solely to observe linguistic data (i.e. statements) and characterize them according to certain taxonomic categories (e.g. words, morphemes, vowels, consonants etc.). From the perspective of scientific research programs, one can affirm that the longevity and originality of the Generative Program derives from its capacity to pose intriguing questions, suggest relationships between apparently trivial phenomena, formulate empirical and complex generalizations and principles that can explain phenomena seemingly unassociated with each other and found in languages that would be considered radically different at first glance. Minimalism chooses negative data as the core *explanandum*.[4] The goal, as Chomsky emphasizes in a number of excerpts, is not creating formal devices that can generate sentences in a particular natural language.

The level of appropriateness of the descriptions and theoretical vocabulary employed is a critical empirical problem, and it requires that the linguistics hypotheses be constantly refined. As the patters observed in a language are compared against other data and languages, it is possible (in principle) to achieve more reliable generalizations and, therefore, formulate linguistic principles that will integrate the theory of the Universal Grammar, the theory about universal linguistic principles. Ludlow (2011) explains that such principles are indispensable for the Generative Program, as they allow a number of problems and phenomena to be unified into one common vocabulary.

[4] To a discussion about the Lakatosian nature of the Minimalist program see Boeckx (2006).

2.2.2. NEGATIVE HEURISTIC

The hypothetico-deductive model provides the formal principles that form the 'protective belt' of the Generative Grammar.

Such principles ultimately indicate the boundaries that limit the expansion of the generative program. This means that the explanations must be formulated by using the formal resources available based on the 'analysis technology' provided by linguistic theory. However, such explanations sometimes depend on 'holistic inferences', i.e. on the linguist's grammaticality judgments. These inferences are holistic because data are usually analyzed by means of informal methods, and not by quantitative, statistical or other mathematical methods beyond the formal model provided by syntactic theory. Empirical generalizations, therefore, play a dual role in linguistic theory: on the one hand, they are used to construct theories; on the other hand, they are used as evidence to confirm theories. The apparently circular nature of this procedure makes it difficult for one to obtain an independent criterion to assess the status of each theory (i.e. the status of the hypotheses assumed by the theories). In other words, it is difficult to distinguish between the phenomenon under analysis and the hypotheses provided to explain it.[5]

If the analysis principles remain uncriticized, the program's negative heuristic is forced to expand. The 'protective belt' of the theory must be expanded so that the principles assumed are maintained in face of evidence to the contrary.

Thus, the program does not expand its positive heuristic or propose principles that can explain linguistic phenomena in an actual, systematic way. As we know, this situation became clear in the 1980s. There was a wave of highly specific, idiosyncratic parameters used as resources to safeguard the principles adopted.

3. CHOMSKY'S CRITICISM OF EXTENSIONAL SEMANTICS

Some examples that are problematic for formal semantics, as traditionally conceived (Chomsky 2000), are provided below:

(1) France is hexagonal and it is a republic.

[5] For a discussion about the reability of data in syntatic research, see Ott (2017).

(2) This administration does too little for the average Brazilian, whose children will inherit the social security deficit.
(3) Hamlet lived with his parents in Denmark.
(4) Unicycles have wheels.

If there is an extensional semantics theory underlying natural languages, then the domain of the entities indicated by lexical items should be, at least in principle, specifiable. It is necessary to assume that the sentence values are determined compositionally and, more importantly, that each sentence value corresponds to a truth value. Vagueness is a huge problem: how can a function be determined if the extension of the predicate is vague, if it cannot be accurately determined? In (1), it seems difficult to pin down the type of entity that could be considered the bearer of the predicates 'to be hexagonal' and 'to be a republic'. It is possible to find contexts in which sentence (1) has a meaning and is true. However, as Chomsky questions, would that suggest that there is something that is hexagonal and a republic? In other words, what is the bearer that is capable of satisfying such distinct properties? Therefore, despite being intelligible, sentence (1) has a meaning that cannot be determined compositionally on a prima facie basis. The problem found in sentence (2) is about specifying what the noun phrase 'the average Brazilian' refers to. What is its extension? How to determine such an extension? Sentence (3) provides an admittedly complex example involving fictional entities. It is possible to find circumstances in which (3) has a meaning and is true. However, what is the truth bearer of the sentence?

Sentence (4) seems to involve counterintuitive consequences, since (4) can only be true if each unicycle has wheels (i.e. more than one wheel). This means to say that the truth conditions seems to authorize instances such as:

(5) John has a unicycle.
(6) Therefore, John's unicycle has wheels.

We intuitively know, however, that sentence (4) will be true if each unicycle has one (and only one) wheel. It is easy to notice that the truth in sentence (4) does not guarantee that sentence (5) is true. On the other hand, the truth in sentence (4) causes sentence (6) to be true:

(7) Cars have wheels.
(8) John has a car.

(9) Thus, John's car has wheels.

Let us analyze the following sentences:

(10) Beavers are mammals.

(11) Beavers build dams.

In (10), the predicate 'to be a mammal' applies to the 'beaver' species. In (11), the same predicate applies to the prototypical group of beavers (i.e. the ones that live in the woods, not in laboratories etc.). This small sample shows the difficulties found when attributing truth conditions to natural language sentences. These examples show one main feature of natural languages: lexical items have a flexible structure, they introduce the vagueness and flexibility that are typical of natural languages. In all examples, determining the truth conditions seems to depend on a heterogeneous set of factors, which causes the attribution of truth conditions in each sentence to vary slightly.

According to Chomsky, the isomorphism between the language and the world commits the semanticist to the existence of exotic entities. The following examples show that there is no correspondence between linguistic categories and ontological categories:

(12) The flaw in the argument is obvious, but it escaped John's attention.

(13) The average family has 2.3 children.

Chomsky's argument is that if there is a bi-univocal relationship between the structure of linguistic items and the entities denoted by them, then the noun phrases 'the flaw in the argument' and 'the average family' presumably denote entities whose ontological status is obscure at best.

Chomsky argues that there is a mismatch between the type of individuation that we intuitively attribute to objects and substances and the type of individuation provided by formal semantics, as shown in the example below.

(14) Val(x, water) = 1 iff $x = H_2O$

Does the lexical item 'water' in the phrase 'The water of the Tietê River' denote the chemical substance H_2O? If not, assuming that the meaning of the phrase is formed by what its lexical items denote seems questionable. Let us suppose that 'water' denotes the chemical substance H_2O in this phrase. We know that a cup of tea

proportionally contains more H_2O than the Tietê River.[6] However, since the lexical item 'tea' does not designate the chemical substance H_2O (but rather a mixture of water and herbs) and, additionally, 'tea' and 'water' are different lexical items (therefore, they have different denotations), one can conclude that the Tietê River waters have proportionally more H_2O than a cup of tea.

Chomsky uses this example to show that the use of the term 'water' depends on a complex set of social conventions, and that the criteria of individuation of this item is not as simple as the formal semanticist would assume. They involve complex application conditions that do not depend on the chemical composition of water (or on the grammatical structure of the lexicon). Chomsky emphasizes that the use of a word can be determined for certain purposes, but that would be a normatization that is not associated with the laws of nature. They are theoretical constructs (e.g. 'matter', 'weight', 'c-command') and, therefore, they do not need to satisfy the myriad of intuitive applications that these terms have in everyday language. 'Water' and 'tea' are not terms from scientific theory. They are items used in our ordinary speech. Their application and identification criteria are vague and variable according to the context. Speakers are the ones who use words and sentences based on their perspectives and intentions. Therefore, there is no nomological relationship between the levels of articulation that form the natural language (phonetics, syntax and semantics) and the world.

As Putnam (1973) emphasized, linguistic items on their own do not suffice to determine whether an object falls under the extension of a concept or not. The link between language and the world is governed by convention. According to Chomsky, the reference relationship is not between language and extra-linguistic objects, as it is not established by the 'linguistic community'. It is mediated by a plethora of intentions, conventions and perspectives. From Chomsky's point of view, this relationship is beyond scientific inquiry. It is even beyond the possibility to provide a coherent description.

[6] As we know, the Tietê River currently contains a wide variety of chemical compounds from the waste discharged in its waters on a daily basis. We also know that the amount of solute in a cup of tea (i.e. the chemical compounds of the tea) is proportionally smaller than the amount of solvent (i.e. water or H_2O, if you will).

Chomsky (2000) discusses a number of points related to contemporary semantics and ponders on the general format of semantics within the generative, Minimalist Program.[7] In this model, the faculty of language (FL) is a computational system (CS) that acts on a lexicon, generating a phonetic form (PF) and a logical form (LF[8]) for each lexical item. PF and LC, in their turn, interface with other cognitive systems. Additionally, there is a Spell-Out operation that feeds the interfaces.

The concept of SEMs[9] is very important in the Minimalist Program. It is a theoretical construct that Chomsky uses to represent the potential semantic perspectives provided by lexical items as they are computed by the faculty of language. SEMs would be the inputs for the conceptual-intentional module, i.e. the reference and categorization perspectives that are available to speakers and that allow them to engage in communicative activities so they are able to deal with the world that surrounds them. These perspectives do not come directly from the world. Rather, they are conceptualization capacities that enable interaction between speakers and the world. They are hypothetical mental entities that translate the linguistic inputs for the conceptual-intensional module. Chomsky is not concerned with the definition of 'meaning'. It is about the contribution of the I-Language (algorithmic procedure internalized by speakers) to the generation of specific human skills. In this sense, SEMs are syntactic entities. They are theoretical descriptions provided by the GG about the linguistic meaning. They include semantic and categorical features, but not the language-world relationship as a theoretical, explanatory term. The explanation of the language-world relationship can be seen as the ultimate ('bold') objective of the semantic theory. It is the inquiry's ideal finish line, but not a starting point. This idea is still in an embryonic stage in the Minimalist Program.

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[7] See Chomsky (1965, 1965, 1977, 1986) and his criticism towards formal semantics and his view according to wich meanings are generated by and internal to the human mind.

[8] A logical form, according to generative syntax, does not mean a formal sentence with a first-order predicate logic, but rather a conversion of lexical items into structural descriptions that explain the categorical and semantic requirements of each item.

[9] See Ludlow 2003.

Chomsky does not oppose formal semantics, but he criticizes some of its assumptions. His position may be summarized in the following points (Chomsky 2012):

(i) Rejection of the assumption that there is a transparent relationship between the structure of the language and the structure of the world;
(ii) Separation of colloquial terms from scientific ones: science invents its own concepts; it does not discover essences, not of water, mountains or meanings;
(iii) Rejection of ontological questions outside of a well-defined theoretical framework;
(iv) Separation of language from the use of language: for research purposes, certain mathematical properties that are part of the human language are studied (i.e. the I-Language);
(v) Rejection of the autonomy of meaning. Sentences and words do not carry full meanings that can be separated from a complex inter-relation between beliefs, context etc.

D'Agostino (1986) points out that Chomsky's position on the denotational interpretation of semantics is closely related to the empirical and theoretical work developed by him and other collaborators. Such work consists of theses that emerge from reflection upon empirical research. As we can see, the propositions above are indeed, to a greater or lesser extent, associated with the generative program and the methodological guidelines that govern empirical research. Propositions (ii)-(iv) are the direct reflex of a methodological choice: internalism. Propositions (i) and (v), on the other hand, summarize Chomsky's philosophical position on the nature of meaning.

Chomsky's position on semantics absorbs the criticism triggered in the second half of the twentieth century by the pragmatic turn (Taylor 1985), according to which many semantic problems accumulated by the analytic philosophy based on a formal and logical tradition, a tradition that prevailed at the beginning of the twentieth century, were solved or even dissolved by the analysis of the use of language. Chomsky affirms that his conception of 'meaning' is closer to the one defended by Austin and Wittgenstein. In a number of papers and books (Chomsky 1977, 1986, 1995, 2000, 2012) he insists that linguistic items (i.e. words and sentences) are used in a myriad of functions:

referring, describing, affirming, insisting, joking. The use of language is a form of action, and actions are free. They cannot be subjected to scrutiny, although it is possible to describe certain interesting correlations (e.g. the speech act theory). Linguistic items are used in certain circumstances to refer to or denote aspects and events of the world. They are used to represent things, the state of things, circumstances etc. There is no doubt about this point. However, he argues that this does not result in a reference relationship between one linguistic item and the other and between linguistic items and what they refer to. Linguistic items do not refer to anything. People are the ones who refer to something when using linguistic items. It is not necessary or uncontroversial to assume, for instance, that a verb such as 'to sing' corresponds to a unary predicate, which is satisfied by individuals who sing. Furthermore, since it is not possible to determine the extension of vague predicates (i.e. it is not possible to determine the members that 'fall under' the extension of the predicate), interpreting the extension of a predicate as its semantic value seems questionable. The metalinguistic formulas employed in formal semantics would be relegated to the status of 'hybrid expressions', semi-formal paraphrases which do not characterize functions.

Chomsky incorporates such criticism, but he does not accept the assumption that linguistic meaning is determined by use. According to Chomsky, such a perspective means that language acquisition is a process of introjection of a practical skill, and that children simply learn to mimic and reproduce adults' patterns of speech based on the observation of the linguistic behavior of the 'speaking community'. Thus, linguistic competence would be equal to a manifestation of a certain type of social behavior.

Linguistic theory is not expected to provide a 'linguistic creativity science'. Chomsky believes that the science of language has something to say about that. He emphasizes, however, that there is a difference between explaining the creative (intelligent) behavior and explaining what makes that creative behavior possible.

4. I-SEMANTICS: DENOTATIONAL APPROACH

Larson and Segal (1995) support the theory that semantics should be seen as a field of cognitive psychology. They try to include their proposal into the generative program, borrowing not only the formal resources developed by generative grammarians, but also the conceptual assumptions that guide this program.

There are two basic foundational problems related to the formulation of an 'I-semantics'. They consist of the definition of its object of study (i.e. the domain of the research) and the nature of the phenomena encompassed by this approach. Such problems can be formulated as follows:

(P1) What is the object of study?
(P2) What are the theoretical goals?

A possible starting point would be to analyze how grammar influences the organization of semantics. According to Larson:

> As speakers of English, we know facts about syntax: for example, that expressions divide into categories like verb, noun, preposition, and adjective, that verbs and prepositions typically precede their objects in English, that words in a sentence cluster into constituents. In addition, we know facts about the semantics, or meaning structure, of English: that sentences are related as synonymous or contradictory, that they are true under certain circumstances, that certain notions do not correspond to possible worlds (Larson 1995, p. 361)[10]

In order to explain this ability, Larson and Segal claim that it is necessary to assume that speakers have semantic knowledge. The I-semantics, according to them, would have the theoretical goal of explaining the speakers' tacit, internalized semantic knowledge:

> To view the subject matter of semantics as linguistic knowledge is to locate the place of semantic theory within the general enterprise initiated by Noam Chomsky (...) for whom linguistic theory is a theory of real knowledge of speakers. This project contrasts with a variety of other commonly held views of the subject matter. (Larson, Segal 1995, p. 16)

Therefore, the I-Semantics has to explain the knowledge underlying the speakers' semantic competence, the knowledge that makes

[10] Some aspects of the original proposition by Larson and Segal (1995) have been developed in previous papers. Furthermore, it is adopted by Borg (2004) as technical guidance in her defense of semantic minimalism.

speakers able to evaluate the truth condition of a sentence; to investigate whatever gives the speakers the capacity to judge truth or falsehood in the sentences; and to clarify the knowledge underlying these judgments. Semantic theory, in particular, has to demonstrate how strictly semantic aspects, independently from context, determine the truth and satisfiability conditions of every lexical item (i.e. demonstrate that the lexical item 'cat' refers to a cat, and that 'is on the rug' corresponds to an event etc.).

Larson and Segal affirm that the knowledge of the truth conditions of a sentence can be analyzed as an instance of a disquotational scheme:

(6) *The cat is on the rug* is true iff the cat is on the rug.

A semantic theory should infer the technical counterparts of the intuitive semantic judgments, particularly of disquotational truths such as (6). We would then come closer to the idea that the knowledge of the meaning of an S-sentence corresponds to the knowledge of its truth conditions. The sentence to the left, in italic type, is a sentence of the metalanguage denoting a sentence of the object language. To the right we have the truth conditions that must be satisfied in order to make the sentence in the object language true. Therefore, the sentence on the right is a metalinguistic one, which expresses the corresponding state of things designated by the object language. By intuition, if speakers know of this equivalence, they know the meaning of the sentence 'The cat is on the rug'.

'Semantics' and 'Syntax' are usually regarded as fundamentally different fields of inquiry. Such a distinction seems reasonably clear in logical-mathematical terms. 'Syntax', on the one hand, is merely a set of rules of good formation based on primitive symbols. 'Semantics', on the other hand, provides the satisfiability conditions for well-formed sentences. However, this distinction requires the assumption that there is a bi-univocal relationship between structure and meaning. Lewis (1972) introduces the idea that there are <syntax, meaning> pairs and interpretation restrictions: certain meanings are not attributed to certain structures. However, Larson and Segal point out that this picture is incomplete. According to Lewis, 'badly formed sentences' (i.e. 'faulty', 'incomplete' structural descriptions) do not carry any meaning. Lewis assumes that sentences in the natural language are

the counterpart of well-formed formulas. Therefore, if a formula is not well structured, it is not semantically interpreted. By analogy, if a sentence is faulty, it cannot be semantically interpreted. What Larson and Segal introduce is the generative perspective, in which 'faulty' sentences have a meaning, as do their grammatical counterparts. That is to say that a sentence, although 'faulty', is interpretable; therefore, it cannot be excluded from the research.

According to the perspective adopted by Larson and Segal, the I-semantics must infer the sentence-meaning pairs. This idea can be summarized as follows, considering the relationship between sentence '*S*' and proposition '*p*':

(7) *S* means *p*.

There would be a structural representation of *S*, represented by *X*, and it would be possible to conclude that '*X* means *p*'. Similarly, if there are negative data, an interpretation restriction, we would have:

(8) *S* cannot mean *p*.

This would be the same as to say that there is a description of *S*, i.e. *X*, based on which we cannot conclude that '*X* means *p*'. Although they assume the 'work division' between syntacticians and semanticists is analogous, Larson and Segal understand that the faculty of the language contains a module that is specifically semantic, and, therefore, there is a basic distinction between syntax and semantics. Ultimately, the authors aim to characterize the 'semantic module'. It would be responsible, according to Larson and Segal, for the tacit knowledge of the semantic properties and relationships present in the natural language.

Larson and Segal assume that the speakers' capacity to understand sentences comes from a tacit, unconscious knowledge of model-theoretical axioms. According to Larson and Segal, when there is a structural description, *X*, the semantic theory has to demonstrate that the interpretation of such structure is stable, unique and determined by the lexical items that compose it and its structural arrangement.

One could affirm that the objective is similar to that of syntactic theory, since said theory is to demonstrate that lexical items generate a univocal structural description when they are grouped according

to certain compositional principles. Considering grammar has a syntactic and a semantic component (even if in different modules), Larson and Segal modify Lewis's perspective regarding the object of study of semantics. They do not deny that ontological commitments are presumed in everyday speech: the speakers assume the existence of certain objects and relationships between such objects. However, according to Larson and Segal, the semantic theory should not expect from ontology an answer about 'what exists', about the kinds of entities that are referred to, so that it can be regarded as a discipline. On the contrary, they claim semantics is expected to provide, within the limitations arising from the field of research itself, support to the clarification of this kind of inquiry. Larson and Segal suggest that the counterexamples presented by Chomsky neither refute nor are they counterexamples against attempts to build an extensional semantic theory for natural language. They believe these cases should be considered and answered individually. They would not undermine the semantic research, but rather encourage it.

Larson and Segal assume that, when children acquire a language, they acquire the capacity to map linguistic signals onto concepts. They assume there is a bi-univocal connection between linguistic structure and conceptual structure. Therefore, a lexical item such as 'dog', for example, corresponds to the concept of DOG; the syntax combines the lexical items and, as a consequence, it is responsible for combining them with the corresponding concepts. By accepting these assumptions, it is possible to provide a 'psychologicalized version' of the T-schema. The seemingly unsolvable examples are then solved:

(15) France is hexagonal and it is a republic iff FRANCE IS HEXAGONAL AND IT IS A REPUBLIC.

(16) This administration does too little for the average Brazilian, whose children will inherit the social security deficit iff THIS ADMINISTRATION DOES TOO LITTLE FOR THE AVERAGE BRAZILIAN, WHOSE CHILDREN WILL INHERIT THE SOCIAL SECURITY DEFICIT

(17) Hamlet lived with his parents in Denmark iff HAMLET LIVED WITH HIS PARENTS IN DENMARK.

This typological solution is not satisfactory at all. Our encyclopedic knowledge tells us that France is an institution, that it has space-time

coordinates etc. We also know the cartographic representation of the territory of France corresponds to a hexagon, or at least resembles one. Therefore, as Chomsky claims, the lexical item 'France' provides us with certain notions. Some of this item's peculiarities are related to the history of France, others to the speaker-listener's geographic knowledge, or their personal experiences with French cuisine etc. The speakers have beliefs about these peculiarities and can express them in different circumstances. However, it would not be reasonable to expect that a paraphrase such as (1) would be able to refer to all of these uses. From the linguistic standpoint, 'France' is a term of a certain type (N) and has some semantic features (-agentive, +thematic, -animate etc.). Such features allow for certain semantic perspectives. Linguistic expressions trigger representations whose elements do not necessarily coincide with the linguistic structure in which these expressions are applied. Therefore, the psychologicalized version of the T-schema shows little explanatory advantage.

Larson and Segal assume that there is a bifurcation between rules of sentence formation for well-formed sentences in a formal language (syntax) and the formal interpretative resource that provides satisfiability conditions (in a model) of well-formed sentences (semantics). It means that, while building a semantic model, the semanticist has certain pre-theoretical expectations. The indisputably accepted expectation is that there is a dichotomy between syntax and semantics.

This technical distinction (as well as technical notions such as 'reference', 'truth', and 'satisfiability', critically analyzed by Chomsky) cannot be taken as a basic explanatory principle to explain linguistic phenomena. Consider the categorical and semantic constraints imposed by the nature of lexical items such as the following verbs, which are well-known examples given by Chomsky:

(1) John is eager to please.
(2) John is easy to please.
(3) John is eager that he please relevant parties.
(4) John is easy that relevant parties please him.
(5) # John is eager that relevant parties please him.
(6) # John is easy that he please relevant parties.

It is clear that there is an interaction between the meaning of the lexical items and the argumentative and thematic structure that each

one of them imposes. None of these restrictions is explained by the psychologicalized version of the T-schema:

(T) 'to please' is a transitive verb that corresponds to the PLEASE concept;
(T) 'eager' is a predicate that indicates the EAGER concept;
(T) 'easy' is the direct object that indicates the EASY concept.

It is important to emphasize that generative grammars were not conceived for the purpose of generating grammatical or well-formed sentences. They are heuristic tools used by syntacticists to unveil the computational principles underlying the grammatical operations. The phrase 'syntax-semantics interface' can be deceiving, since it suggests that there is a line between the two levels of linguistic articulation: on the one side, there is 'syntax'; on the other side, there is 'semantics'. A robust proposal must explain relevant data and not graft the explanation onto semantic formalism. It seems that there are more complex, interesting phenomena than the so-called 'syntax-semantics interface' appears to suggest:

> In general, one should not expect to be able to delimit a large and complex domain before it has been thoroughly explored. A decision as to the boundary separating syntax and semantics (if there is one) is not a prerequisite for theoretical and descriptive study of syntactic and semantic rules. On the contrary, the problem of delimitation will clearly remain open until these fields are much better understood than they are today. Exactly the same can be said about the boundary separating semantic systems from systems of knowledge and belief. (Chomsky 1965, p. 159)

Chomsky affirms that semantics is a form of syntax. What does that mean? Does that mean to say that semantics can be reduced to syntax? I believe that Chomsky's assertion can be construed as follows: What a formal semanticist truly does is a form of syntax. In other words, the difference between syntax and semantics is purely nominal. As we know, in formal semantics, it is assumed that there is a bifurcation between the rules of formation of well-formed sentences in a formal language (syntax) and the formal interpretative resource that provides satisfiability conditions (in a model) of well-formed sentences (semantics). That means to say that syntax offers the set of interpretable sentences and semantics provides a set of interpreted sentences.

Larson and Segal assume that there is a relatively transparent relationship between the grammatical form and the logical form[11] and a relatively transparent relationship between the logical form and the structure of the world.

The authors defend a certain form of semantic internalism, a psychologicalized version of formal semantics, according to which a semantic theory must be constructed as a system of mental representation of the world. Once this kind of semantic internalism is admitted, it is then necessary to provide answers to a series of problems: how to bring the notion of an I-Language, which is internal, individual and intensional, closer to the notion of reference, which is external to the individual? Is it possible to find referential semantics in the I-Language?

There is an unresolved problem that must be considered: what exactly is the research object of an I-semantics? Although they were nominally committed to the goals of the generative program, Larson and Segal do not consider this an unresolved problem to be examined. Therefore, they assume that semantic theories are extensional theories, i.e. theories about the truth conditions of sentences. Consequently, an I-semantics should be conceived in these terms.

This approach becomes intelligible (or at least coherent) in an E-language, taking on an extensional definition, i.e. assuming, from the very beginning, that the language flows as a finite set, S, composed by a finite number of sound-meaning pairs or well-formed formulas – interpreted formulas (in a model). Thus, the nominal objectives of Larson and Segal (i.e., integrating formal semantics into the generative program) are undermined by these assumptions. This version of I-semantics lies outside the scope of the generative program.

5. I-SEMANTICS: INTENSIONAL APPROACH

In the preface of Events and Semantic Architecture, Pietroski presents, in a clear and concise way, the essential objective of his proposal:

[11] Larson and Segal interpret the 'autonomy of syntax' as a strict division between syntactic competence and semantic competence. They would be different cognitive domains that should be 'connected' and 'mapped' by the semantic theory.

> One of my goals in writing this book (...) has been to get free of some assumptions (...) that a semantic theory for natural language will associate predicates with sets and sentences with true values. (Pietroski 2005a, p.1)

The author explicitly rejects assumptions that are the groundwork of the extensional semantics. He proposes a revision of such assumptions and, consequently, of the objectives that define the semantics of natural languages. However, he does not suggest that the technical tools inherited from the logical-formal tradition should be completely abandoned.

The argumentation used by Pietroski to sustain his proposal can be schematically summarized in the following items:

(A1) Meanings are internal properties of linguistic expressions;
(A2) Meanings are instructions for the construction of concepts;
(A3) Lexicalization consists (at least partially) of a creative process of abstraction.

Although logically independent, (A1)–(A3) are contrary to the assumption that there is a clear relationship between syntactic structure and semantic content. (A1) is a methodological assumption that serves as the modus operandi used by generativism in the study of linguistic phenomena. It should be noted that the semantic internalism defended by Pietroski must be seen as a methodological perspective regarding the study of meaning rather than a thesis about the nature of the semantic content. In the following, I will examine the importance of (A1), how syntax, in the context of the generative program is explanatory and, in this context, semantics is not. Therefore, in order to formulate an I-semantics, it is necessary to review certain foundational assumptions commonly accepted in formal semantics

6. HOMOPHONY RESTRICTIONS AND NEGATIVE DATA

In Pietroski (2005b), the author tries to explain what generativism can teach us about the nature of meaning and the nature of semantic theories. The answer offered by generativism is essentially negative: it teaches us what meaning cannot be, certain interpretative restrictions that deserve attention.[12] Let us see a summary of his argument. The

[12] One should notice that this does not mean, as Larson and Segal assume, that the structure descriptions provided by the generative grammar are incor-

generative perspective, Pietroski claims, does not accept the hypothesis that a natural language associates linguistic items to model-theoretical conditions of truth, because the I-Language imposes only a few intelligibility restrictions. It imposes a format for possible, but not achievable, constructions in natural languages. In summary, negative data are related to the relationship between word sequences and their intelligibility, between sound and meaning. According to Pietroski, it is necessary to explain these patterns. There are two kinds of restriction :

(i) The faculty of language imposes restrictions that are independent from any limitations imposed by other cognitive systems;
(ii) The source of these restrictions is in the interface between the faculty of language and other cognitive systems (perception, conceptualization etc.).

As an example of a restriction of type (ii), there are restrictions in the processing of connected sentences (there is a limit, imposed by the working memory, to the number of adjuncts that can be processed), cacophony, states of language (interface between the computational system and the articulatory system) etc. As an example of a type (i) restriction, Pietroski provides the following:

(1) The senator called the millionaire from Brasília.
(2) The senator called the millionaire, and the millionaire was from Brasília.
(3) The senator called the millionaire, and the call was (made) from Brasília.
(4) # The senator called the millionaire, and the senator was from Brasília.

Here we have negative data, Pietroski explains: sentence (1) has the meaning indicated in (2) or (3), but it does not have the meaning suggested in sentence (4). That means sentence (1) admits a finite

porated *only* as empirical evidence for the semantic theory or only as an analysis technique for sentences in the object language. On the contrary, they are about taking into consideration the generative *principles* responsible for the combinatory restrictions. In short: it is not about the application of the analysis technique when examining *particular* cases. If that were the case, such restrictions would be of little interest. Grammar, as Larson and Segal tacitly assume, would serve as a boundary for the set of *sentences* of the object language that can be subjected to semantic interpretation.

number of paraphrases, i.e. there is a limited number of ways in which the structure of constituents can be arranged. Sentence (1) has the meaning indicated in paraphrases (2) and (3), but not in paraphrase (4).[13] At first glance, it seems possible to build an algorithm capable of associating sentence (1) to paraphrase (4). However, as Pietroski emphasizes, it is an empirical phenomenon, and speakers-listeners do not make such an association.

The structure of constituents that originates (2) and (3) respectively corresponds to:

(1') {[The senator] [called [the millionaire [from Brasília]]].}
(1'') {[The senator] [[called [the millionaire]] [from Brasília]].}

Therefore: in (1'), 'from Brasília' is an adjunct to the phrase 'the millionaire'; in (1''), 'from Brasília' is an adjunct to the verb phrase 'called the millionaire'. The ambiguity in (1) is the result of two different scope relationships, but not of three or four or four hundred.[14] This example indicates that the ambiguity phenomenon has several degrees. It is clear that the ambiguity in (1) is resolved when there is a context, but can we say that the structural ambiguity phenomenon does not exist, that it is not a phenomenon that requires explanation? The brackets in (1') and (1'') indicate that the homophony phenomenon (expressions that contain the same phonological representation, but different meanings, such as 'bank' [financial institution; slope of land adjoining a river]) is subject to structure restrictions that are very specific and elaborate. Pietroski defends this as a good starting point for an I-Semantics, since it is a ubiquitous phenomenon, found in every natural language and in a large number of sentence constructions. Pietroski also emphasizes that there are no 'maximally homophonous' languages, i.e. although it is logically possible that there is a potentially infinite number of homophones in every language (e.g. alternative pairs of brackets), homophony is subject to restrictions (as in sentence (4), for example). Homophony (sounds that have different structural descriptions) is restricted. Not

[13] It is possible to infer that this semantic *relationship* is also subject to constraints, because sentence (1) does not lead to sentence (4).

[14] It is curious to notice that it is possible to find out what an ambiguous sentence *cannot* mean. However, it is virtually impossible to exhaustively specify what a sentence *can* mean, in every possible context.

all combinations are homophonous in the same way. That is especially the case for 'negative data', the meanings that are not allowed by the sentences. This example shows that ambiguity happens in different degrees: sentence (1) is ambiguous because it is related to two interpretations, but not three, thirty or three hundred. In other words, certain structures express a number n of meanings, but not $n + 1$.

(5) # The called the millionaire senator from Brasília.

It is important to notice that sentence (4), which has a different meaning, also expresses a coherent thought. It does not have/show the deviancy as in sentence (5). There is not a semantic or pragmatic restriction that bans paraphrase (4). It is a structural constraint. If by saying (4) the speaker actually meant (2), we would have understood 'what he meant' and also noticed that the speaker 'expressed himself/herself badly'. One could claim that, in the example above, the interpretative restriction is produced by the predicate 'to call', which would be semantically satisfied by $<\alpha, \beta, \upsilon>$, an ordered triple, being two individuals and one space-time location: <millionaire, senator, from Brasília>. However, this is an empirical hypothesis about the example analyzed. Thus, it should not be regarded as a phenomenon that semantic theories must explain. Moreover, from a strictly extensional standpoint, it does not matter how functions are specified. Once the interpretations are extensionally individuated, it does not matter what the pairing procedure is, only which pairs are generated. Therefore, the difference between (1) and (4) would be simply extensional.

These phenomena are a strong indication that syntax mediates the connection between sound and meaning, but it does not determine such connections. From a technical perspective (from the formal repertoire of first-order predicate logic, for example), on the other hand, syntax determines the interpretations, because it provides the model with a set of potentially interpretable formulas. It is an idealization that is inadequate to the study of the semantics of natural languages.

Another well-known phenomenon in the generative literature is anaphora. Consider the following sentences:

(5) John said he is going out.
(6) He said John is going out.

If we were to ask: who is going out? In (6), the answer is clear: John. However, in (5), if we were to ask the same question, would the answer be John? It is impossible to determine. These restrictions produce interpretative semantic effects.

The generative program has made explicit that 'negative data' include the phenomena that involve the complex interrelation between linguistic items. The 'island' phenomenon, for instance, suggests that there is a complex interaction between displacement operations and syntactic configuration. We can, for example, use the phrase from the sentence 'John wrote a book' to generate the sentence 'This is the book John wrote'. However, if we try to take the same phrase from the sentence:

(7) John married the woman who wrote a book.

We will generate an ungrammatical sentence:

(8) * This is the book which John married the woman who wrote___

As Stainton (2006) claims, the grammatical relationships generate very important interpretation restrictions. The semantics of verb phrases, for example, is subject to the thematic relationships imposed by the syntactic structure:

(9) Caesar killed Brutus.
(10) The toast pressed charges at the police station.

The distribution of thematic roles is clear: the external argument of the verb 'to kill' plays an active role, while the internal argument, 'Brutus', plays a passive role. I believe these examples are very suggestive, since they show that interpretation restrictions can violate our encyclopedic knowledge (we know Brutus killed Caesar, not the other way around) and our beliefs (we know toasts cannot press charges and dogs do not know how to do their taxes etc.). Despite all we know about toasts, animate and inanimate beings, the most reasonable meaning is not the one expressed in the sentences, but rather the 'bizarre' meaning. This example shows even more clearly that the interpretation restrictions imposed by language might not respect our beliefs, i.e. they do not have the meaning we (our common sense) would expect.

Chomsky's work always analyzed interpretation restrictions, even though he did not name that study 'semantics'. In fact, the examples provided are a small sample of a solid pattern, a converging result originating from many lines of empirical research conducted in the past 50 years: slight differences in the pattern of the connection of constituents produce considerable interpretative effects. The examples Pietroski offers are not used as rhetorical pieces to confirm a specific semantic hypothesis; they are a small sample of a phenomenon typical of natural language.

The examples also show that the notions of grammaticality and intelligibility do not coincide, but that they interact in a complex, intricate way. It is customary to assume that 'semantics' and 'syntax' are fundamentally distinct fields of research. This distinction seems reasonably clear in terms of logics and mathematics, in which syntax is merely a set rules for good formation, based on primitive symbols of the system, and 'semantics' provides satisfiability conditions, in a model, for well-formed sentences. According to this technical definition, syntax provides a set of structures that can be interpreted. However, in order for such a distinction to be valid, one must admit that there is a function that relates the 'semantics' and 'syntax' domains, that there is a bi-univocal relationship between structure and meaning. In a model, it is neither possible to correlate different interpretations to the same well-formed formula, nor to assign the same interpretation to different formulas. Logical systems do not tolerate ambiguity. In logical systems, syntax and semantics are different, unlike what happens in natural languages. Chomsky's criticism is directed at how this technical division influences the usual conceptions about natural languages and, more importantly, their semantics. As we know, even sentences considered semantically 'strange' are accepted and considered grammatical. This is a phenomenon the grammar theory cannot ignore. It suggests that the notion of grammaticality is granular; it does not coincide with the technical distinction between well-formed sentences versus badly-formed ones. The formal system prevents the formation of ill-formed (regardless of the 'level' of bad formation), ambiguous sentences etc. The goal of GG has been, from its very beginning, to explain computational restrictions to the pairing of sound and meaning. Certain sequences are not recognized by the speaker as sentences because they violate the structural

principles that govern the connection of constituents, and not because the word sequences are random.

These structural constrains underpin the interpretation of the sentences. It constrains, but does not determine, the meaning of the sentences. I believe this must be emphasized, because restricted homophony provides negative data; it is a *phenomenon* that, justifiably, must be taken into consideration in a semantic theory of natural languages. I believe that, in this field of research, semantic phenomena are the explanatory context of an I-semantics. The restricted homophony phenomenon clearly shows that the notions of well-formed formulas and grammaticality do not coincide; they are not even analogous: grammatical sentences may have unexpected, 'atypical' meanings. The distinction between syntax and semantics, in natural languages, does not follow the technical distinction adopted in logical-mathematical language.

Considering that negative data are the essential object of analysis of the generative approach, how should the objective of an I-semantics be described? What is the role of the logical-semantic metalanguage in the explanation of negative data? Should they be explained in terms of truth conditions, satisfiability and reference?

7. INTERNALISM AS METHODOLOGICAL STRATEGY

The core assumption made by Pietroski to sustain his proposal can be summarized in the following item:

(A1) Meanings are internal properties of linguistic expressions.

In this section, I am going to maintain that (A1) is a methodological assumption associated with the modus operandi of generativism in the investigation of linguistic phenomena. It should be noted that the semantic internalism defended by Pietroski must be seen as a methodological perspective, and not as a thesis about the nature of meaning. From this standpoint, semantic internalism is the perspective according to which linguistic theories do not assume or imply the existence of objects and properties external to the cognitive state of speakers. In short, Internalism is a conjecture about the object of study of the language science, rather than a doctrine about the nature of linguistic meaning. I believe this is the interpretative key to adequately

understand Chomsky's considerations about semantics and characterize the internalism defended by Pietroski.

There are, as discussed in the previous sections, certain interesting, not random, patterns, highly specific phenomena that are far from trivial, which are found in the interaction between the internalized combinatory system and lexical (categorical and functional) properties. The most important point is that these phenomena provide methodological suggestions to semantic inquiry. It is indisputable that certain semantic phenomena depend prominently and decisively on the speakers' system of beliefs and world knowledge. Therefore, we assume that the speakers' knowledge varies considerably. However, as Larson and Segal speculate, if speakers of different levels of knowledge and education experience a certain class of semantic phenomena in a systematic, regular and (relatively) uniform way, the source of such knowledge and its basic mechanisms must be explained. If in the course of language acquisition all children achieve the same kind of generalization, the same kind of semantic-structural knowledge, despite dialectal, cultural and idiosyncratic differences, we will see a version of the argument of poverty of stimulus (POS) applied to 'meaning', to semantics. In other words, if it is possible to identify the features that characterize semantic knowledge, the problem of poverty of stimulus is once more inserted into the semantics domain. It would be possible to formulate the problem in a coherent and precise way. Cook (2007), for instance, affirms that in no natural language does the determinant lexicalize equinumerosity. There is no quantifier of the 'Equi' type, so that in the sentence [Equi] [child] [had] [slice of pizza] = the number of children and number of slices of pizza is the same. That means to say that there is an equivalence relationship between the members of the set denoted by 'child' and by 'slice of pizza.' In order to express equinumerosity, one must use circumlocution, a complex sentence, such as: 'for every child and every slice of pizza, each child had one, and only one, slice of pizza.'

Chomsky (2000) reminds us that linguistics has a large volume of accumulated knowledge about morphology and syntax, i.e. about how words are formed and what joins them together in syntactic structures. He also reminds us, on the other hand, that very little is known about concepts. The most natural strategy in this case, he claims, would be to start with what we know and, then, expand the explanatory power of

the theory.[15] In other words, it is necessary to know if the phenomena to be analyzed form a unit, if they contain a more basic phenomenon, if they form a cohesive set of phenomena.

As in syntax studies, we would have a general methodological principle, the order into which the research is to be broken down, namely:

(i) Analyzing what is implemented (i.e. the format of the representations);
(ii) Investigating how the representations are implemented.

The study of meaning within the generative program would adopt an internalist strategy. At first glance, we can define it as a methodological precept that can be condensed into the following 'advice': observe how the internalized computational component produces sentences, i.e. sound-meaning pairs. According to this perspective, we must admit, from the beginning, that we know little about what, on the one hand, linguistic expressions are and what, on the other hand, the meanings are. Similarly, the internalism defended by Pietroski can be defined as a methodological precept: as far as semantic theory cannot say anything interesting about the relata in question (i.e. linguistic expressions and meanings), it seems hasty to tackle the relationship between statements (i.e. acts in which the signifier and signified are condensed together) and truth conditions. In short, it seems appropriate to start with stage (i), with the analysis of the properties of the phenomenon analyzed. In semantics, as in the case of syntax, the difference between the types of structure found in the several natural languages is expected to be relatively small, since it is accepted, by hypothesis, that the possibilities, the available alternatives in the course of acquisition are biologically determined. Ultimately, the structures should not violate any of the UG principles.

Pietroski breaks the factors that affect the truth conditions of a sentence down into two broad categories:

[15] A brief look at a manual of formal semantics will reveal that this caution is not shared by most semanticists. Judging by the topics contained in manuals, the formal study of natural language semantics is in an extraordinarily advanced stage and dismisses any methodological or metatheoretical considerations of this kind.

(i) Structural properties of linguistic expressions;
(ii) Extra-linguistic factors concerning the communicative situation/ context under analysis (e.g. general assertability conditions).

In the first one, the properties are formally analyzable and have been investigated throughout the Generative Program. As for the second category, they concern a heterogeneous set of factors, presumably less tractable ones. Chomsky has never defined, in his considerations about semantics, the term 'meaning'. He assumes that linguistic expressions have a meaning; or rather, that meaning is a property that linguistic expressions possess (just as they possess phonetic, morphological, and syntactic properties, among others). It seems to me that this is not a problem, but rather a virtue, because it does not mean that one should deny that words have an open texture, moldable to the communicative intentions, or to the perspective of the speaker etc.

Once it is determined that semantics deals with linguistic properties, the generic, most general question about meaning becomes expendable ('what is meaning'?). Whatever meaning is, according to Chomsky's perspective, it is necessary to explain certain non-trivial phenomena, certain properties and relations.

Chomsky and Pietroski remind us that a massive number of heterogeneous elements determine the truth conditions of an assertion. Nonetheless, one can undoubtedly assume that technical terms used in metalanguage (e.g. 'valuation', 'satisfiability' etc.) have an empirically discernible counterpart, instantiated in the use of language. Indubitably, there is a relationship between meaning and use, but it is much more tenuous and intricate than is usually assumed. However, the problems associated with the relationship between content and intension are complex, and extremely difficult to solve. Chomsky would say they are mysteries. It does not seem clear why the hypotheses about these problems should be taken as criteria to decide upon and evaluate theories about the semantic phenomena found in natural languages.

The attempt to establish a systematic semantic theory that is capable of explaining the complex language-action-world triangulation seems to face insurmountable difficulties. However, it is important to clarify that Pietroski does not oppose extensional semantic theories: "I fully endorse the strategy of supposing that the core semantic notions are extensional" (Pietroski 2005b, p. 287). More specifically: "...I am not

objecting that theories of meaning can be formulated in a metalanguage by an extensional logic" (*idem*, p. 285).

Pietroski argues that resorting to truth conditions is a useful heuristic resource, an idealization adopted for research purposes. The author treats the problem as a metatheoretical question. It is useful to treat semantic theories as theories of truth. From a methodological point of view, it is a somewhat advantageous idealization. However, his argument is that adopting this assumption is not independently motivated. Additionally, one might say that his project intends to prove that, in practice, the denotational interpretation of logical-semantic metalanguage can be disregarded without explanatory losses. The idea is not to abandon formal semantic theories, but to reassess their value and explanatory role. It is legitimate to use the formal apparatus of model theory to describe certain semantic phenomena, but this does not mean that such phenomena should be understood from the standpoint of the metalanguage used to describe them. With this perspective in mind, we progressively (i.e., as we become able to deal with complex semantic phenomena) re-evaluate the role of semantic theories.

It is about the methodological decision to combine the heuristic of the Generative Program with the resources offered by semantic models, rather than the incorporation of heterodox conceptual assumptions into the core of basic assumptions that comprise generativism (as proposed by Larson and Segal). The extensional apparatus may help semanticists elucidate certain lexical properties of linguistic items, i.e. properties derived from the interaction between the way syntax connects constituents and their features. Pietroski believes that a modest Davidsonian typology is necessary (indispensable, in some cases) in the semantic analysis, but semanticists do not need to believe that the semantic model postulated by him associates sentences with states of things. That is, the typology employed in semantic theories should not confuse semanticists, leading them to believe that linguistic expressions denote semantic values. Formal metalanguage offers hypotheses, which can be reviewed, on the semantic properties of predicates. It is a necessary idealization for a rigorous investigation of complex semantic phenomena.

This framework generates semantic types and allows us to accurately codify hypotheses on semantic composition in natural languages.

That is, the formal apparatus allows for the refinement of the distinctions between what is said, what is asserted, and the meaning of the words. However, by definition, these aspects are not within the scope of the internalist study promoted by the Generative Program.

Methodological internalism is a strategy consisting of:

(i) Turning the focus of the research away from the language-world relationship;
(ii) Investigating the internal properties of sentences (semantic typology).

From this methodological perspective, the research should not start from general assumptions about the meaning in order to draw conclusions about natural language. On the contrary, the starting point is observing the phenomena ubiquitously present in human language (e.g. restricted homophony, recursion etc.). From this point, an attempt is made to devise a research plan and, gradually, the outlines of an I-semantics will be delineated.

Pietroski's proposal constitutes a research program of a generative nature because it is consistent with the methodological internalism adopted by the generative program and it offers explanations for phenomena that are dear to the generative program, such as negative data. Pietroski's proposal offers an expansion of the positive heuristic of the generative program. We can say that Pietroski's hypotheses do not underestimate the interpretative effects triggered by syntax, but they also do not overestimate the relation between truth and meaning. The expansion of the positive heuristic of the generative program happens at the expense of the revision of the assumptions of formal semantics. Pietroski offers an alternative hypothesis about the semantic composition of natural languages.

8. CONCLUSION

In this article my aim was to characterize an I-semantics, to define the scope of a semantic theory consistent with the theoretical assumptions adopted by the generative program. In 2.1 was presented the hardcore of the generative program. In 2.2, I introduced the methodological foundations of the generative program. Section 3 showed Chomsky's criticisms against extensional semantics. In section 4,

I explained the extensional approach to I-semantics, proposed by Larson and Segal. In Section 5, I explained the proposal offered by Paul Pietroski. After comparing and contrasting these proposals, I argued in favor of Pietroski's proposal, because it is more consistent with the main assumptions of the generative program, and it expands the positive heuristics of the generative program, while the extensional proposal does not expand the positive heuristics of this research program. The main argument was that syntax, in the context of the generative program is explanatory and, in this context, semantics is not. In order to account for the explanatory role of syntax in the generative program it is necessary to review certain foundational assumptions commonly accepted in formal semantics.

REFERENCES

Borg, E. (2004). *Minimal Semantics*. Oxford: Oxford University Press.

Boeckx, C. (2006). *Linguistic Minimalism*. Oxford: Oxford University Press.

Chomsky, N. (1965). *Aspects of the Theory of Syntax*. Cambridge, MA: MIT Press.

Chomsky, N. (1977). *Essays on Form and Interpretation*. New York: North Holland.

Chomsky, N. (1981). *Lectures on Government and Binding*. Dordrecht, Holland: Foris Publications.

Chomsky, N. (1986). *Knowledge of Language*. New York: Praeger.

Chomsky, N. (1995). Language and Nature. *Mind*, 104, 1–61.

Chomsky, N. (2000). *New Horizons in the Study of Language and Mind*. Cambridge: Cambridge University Press.

Chomsky, N. (2005). Three Factors in Language Design. *Linguistic Inquiry*, *36*(1), 1–22.

Chomsky, N. (2012). *The Science of Language: Interviews with James McGilvray*. Cambridge: Cambridge University Press.

Cook, V. (2007). *Chomsky's Universal Grammar*. *An Introduction*. Malden, MA: Blackwell Publishers.

D'Agostino, F. (1986). *Chomsky's System of Ideas*. Oxford: Clarendon Press.

Heim, I., Kratzer, A. (1998). *Semantics in Generative Grammar*. Cambridge: Blackwell Publishers.

Lakatos, I. (1978). *The Methodology of Scientific Research Programmes*. Cambridge: Cambridge University Press.

Larson, R. (1995). *Semantics*. In L. Gleitman (Ed.), *Invitation to Cognitive Science, Vol. 1. Language* (pp. 361–380). Cambridge: MIT Press.

Larson, R., Segal, G. (1995). *Knowledge of Meaning: an Introduction to Semantic Theory*. Cambridge: MIT Press.

Lewis, D. (1972). General Semantics. In D. Davidson and G. Harman (Eds.), *Semantics of Natural Language* (pp. 169–218). Dordrecht–Boston: D. Reidel.

Ludlow, P. (2003). Referential Semantics for I-Languages? In L. Antony and N. Hornstein (Eds.), *Chomsky and his Critics* (pp. 140–161). Malden, MA: Blackwell Pub.

Ludlow, P. (2011). *The Philosophy of Generative Linguistics*. Oxford: Oxford University Press.

Ott, D. (2017). Strong Generative Capacity and the Empirical Base of Linguistic Theory. *Frontiers of Psychology*, *8*, 1617.

Pietroski, P. M. (2002). Function and Concatenation. In G. Preyer and G. Peter (Eds.), *Logical Form and Language* (pp. 91–131). Oxford: Clarendon Press.

Pietroski, P. M. (2003a). Semantics and Metaphysics of Events. In K. Ludwig (Ed.), *Contemporary Philosophy in Focus: on Davidson* (pp. 137–162). Cambridge University Press.

Pietroski, P. M. (2003b). The Character of Natural Language Semantics. In A. Barber (Ed.), *Epistemology of Language* (pp. 217–256). Oxford: Oxford University Press.

Pietroski, P. M. (2005a). *Events and Semantic Architecture*. Oxford: Oxford University Press.

Pietroski, P. M. (2005b). Meaning Before Truth. In G. Preyer and G. Peters (Eds.), *Contextualism in Philosophy* (pp. 253–300). Oxford: Oxford University Press.

Pietroski, P. M. (2005c). Meaning Before Truth Conditions. Handout; available in: http://www.terpconnect.umd.edu/~pietro/research/papers/Arizona1.pdf

Pietroski, P. M. (2006a). Character Before Content. In J. Thomson and A. Byrne (Eds.), *Content and Modality: Themes from the Philosophy of Robert Stalnaker* (pp. 34–60). Oxford: Oxford University Press.

Pietroski, P. M. (2006b). Interpreting Concatenation and Concatenates. *Philosophical Issues*, *16*, 221–245.

Pietroski, P. M. (2007). Systematicity via Monadicity. *Croatian Journal of Philosophy*, *7*, 343–374.

Pietroski, P. M. (2008). Minimalist Meaning, Internalist Interpretation. *Biolinguistics*, *4*, 317–341.

Pietroski, P. M. (2010). Concepts, Meanings, and Truth: First Nature, Second Nature, and Hard Work. *Mind and Language*, *25*, 247–278.

Pietroski, P. M. (2010b). *Describing I-junctions*. Not published; available on: http://terpconnect.umd.edu/~pietro/research/papers/ijunctions.pdf

Pietroski, P. M. (2011). Minimal Semantic Instructions. In: C. Boeckx (ed.). *The Oxford Handbook on Linguistic Minimalism* (pp. 472–498). Oxford: Oxford University Press.

Pietroski, P. M. (2012). Semantic Monadicity with Conceptual Polyadicity. In M. Werning, W. Hinzen, and E. Machery (Eds.), *The Oxford Handbook of Compositionality* (pp. 129-148). Oxford: Oxford University Press.

Pietroski, P. M. (2015). Framing Event Variables. *Erkenntnis*, *80*, 31–60.

Pietroski, P. M. (2017). Semantic Internalism. In J. McGilvray (Ed.), *The Cambridge Companion to Chomsky* (pp. 196–216), Cambridge: Cambridge University Press.

Pietroski, P. M., Hornstein, N. (2002). Does Every Sentence Like this Contain a Scope Ambiguity? In W. Hinzen and H. Rott (Eds.), *Belief in Meaning: Essays at the Interface* (pp. 43–72). Frankfurt: Hansel-Hohenhausen.

Pietroski, P. M., Hornstein, N. (2009). Basic Operations: Minimal Syntax-Semantics. *Catalan Journal of Linguistics*, *8*, 113–139.

Putnam, H. (1973). Meaning and Reference. *Journal of Philosophy*, *70*, 699–711.

Stainton, R. J. (2006). Meaning and Reference: Some Chomskian Themes. In E. Lepore and B. C. Smith (Eds.), *The Oxford Handbook of Philosophy of Language* (pp. 913–940). Oxford: Oxford University Press.

Taylor, C. (1985). *Philosophical Papers. Vol. 1: Human Agency and Language*. Cambridge: Cambridge University Press.