PROLEGOMENON ON THE ONTOLOGY OF COMPLETE OR PARTIAL HOMOMORPHISMS IN THE SYNTAX-SEMANTICS INTERFACE IN GRAMMARS

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Abstract - The formalization of the syntax-semantics interface in natural and formal languages subsumes a number of homomorphisms which are assumed to exist which should be tested and made explicit in Algebraic Linguistic systems. This paper examines selected grammar formalisms in philosophy (model theory) and mainstream linguistics (especially in Generative Grammars). Homomorphisms in the algebraic systems are subject to metaphysical and epistemological assumptions of full or partial access to reality. The paper argues that the homomorphisms should be partial due to the hierarchical nature of linguistic subconstituents in the syntax which are antisymmetrical, and should be implemented entirely using partial algebras in order to meet the constraint of compositionality.This paper notes the failure of some systems to account for the assymetries between perception and reality which are implied by the notions of homomorphisms espoused with reference to analytic and generative context free and context sensitive grammars.

Key Terms - Algebraic Linguistics, Formal Languages, Natural Languages, Analytic Grammars, Generative Grammars, Graph Theory, compositionality

I. INTRODUCTION

It is held that any language, formal or natural, is a pairing of signs (symbols or sounds) with meaning, which as a consequence led to construal of theories that assume that a grammar that does not provide for the connection between the syntax and semantics to be inadequate. However, this aspect has been problematic for theories that espouse a form of modularity, in which syntax is autonomous, such as the Chomskyan stream of Generative Grammars .
The notion of meaning is assumed to be multifacetted and theory-relative, hence it has been defined differently in formal and functionalist (use-based) theories. In linguistics, the model-theoretical semantics theories have worked with the idea that there is a connection between syntax and semantics. Homomorphisms are meant to preserve relation between the objects which are manipulated in one domain onto another. Once the relations are preserved, then it is possible to jump between the various contexts.The stipulation of models in truth-based notions of the syntax-semantics theories (e.g Keenana and Faltz,1986) raises concerns as to whether the formalization of the connection of the two in algebraic systems that assumes the notion there being a homomomophism between the two adheres to the pressuposed philosophical notions of truth.

This paper examines the homomorphisms stipulated in selected works that posit that there are homomorphisms in the syntax and semantics of languages namely Montangues PTQ, English as a formal Grammar and Universal Grammar (cf. Thomassen, 1976); Janssen (1986) who stipulate that there is a homomorphism between a syntactic and a semantic algebra which are similar, or the homomorphisms in a boolean algebraic system for a given language such as Keenan and Faltz (1986), and those that use graph homomorphisms e.g Kratzer and Heim (1998) and Kobele (2006), in order to determine the utility of their formalisms in providing a compositional semantics for natural languages. The paper seeks to examine whether the homomorphisms construed in grammatical formalisms in linguistics are supposed to be partial or complete?

II. HOMOMORPHISMS IN GRAMMATICAL FORMALISMS

In Jansen's algebraic system, the concept of homomorphism has a number of variants in relation to the role they play in establishing some similarities in models.A model is a set M which is non-empty with predicates, □ , (properties and relations) that are boolean (0 (falsum).1 (verum)).

Definition: Let M= V, P and M'=V' br similar models, H a mapping of the set V to V'. H is called a homomorphism of the model M onto M' iff $P \in \wp$ (deg P=n) and for arbitrary elements $x_1, x_2, \ldots, x_n \in V$ then $P(x_1, x_2, \ldots, x_n)=1$ we have $P(\varphi(x_1,) \ldots, \varphi(x_{n)})=1$

Hendriks (2001, 2002) objects to the idea of stipulating the notion of homomorphism on the basis of 'similarity' in Jansenn's grammar in that it is too strong and insists of considering there being a syntax that is interpretable in the semantics. The dismissal of the similarity can be reconsidered in relation to what kind of algebras and the homomorphisms that exist between them. The syntax and semantics can be considered to be similar in so far as they are partial systems that capture reality, perceptual capabilities bein constrained by ignorance of considerable scales.

2.1. Complete vs Partial Homomorphisms

In this section we give an overview of some grammatical formalisms that construe complete homomorphisms (in section 2.1.1) as opposed to those that posit partial homomorphisms and consider the former to be counterintuitive.

2.1.1. Keenan and Faltz's (1985) Complete Functional Homomorphisms

Keenan and Faltz (1985) posist an algebra in which there is a homomorphism defined in relation to functions from one Boolean algebra to another which preserve all the given boolean operations (meets (∧), joins (∨)and complements (¬)). They construe a set of complete homomorphisms, T_{P1} ,from $T_{Й}$ into the the truth value algebra T_S whose number is unknown. The mappings are formalized in the theorem given in () below:

() Justification Theorem (Faltz and Keenan, :13)

For Every function f from the individuals on $T_{Й}$ into 2 there is exactly one (complete) homomorphism from $T_{Й}$ into 2 whose values on the individuals are the same as f.

Consider a case of conjunction in English, such as () below.

() Eat (Martha and Alfred) = eat (Martha) and eat(Alfred)

The P1 denotation assigns to the meet of the Й denotations the truth value that results from the separate function application to each of them . the P1 denotation is therefore assumed to be complete by virtue of preserving the intersection. The assumption overlooks the flouting of the syntactic identity which should accompany the semantic identity of the costruction. It therefore, assumes a notion of homomorphism which overlooks the alteration that have occured to the syntactic algebra. This arises because they do not consider the derivational history of the construction, which precludes the consideration of the scopal differences that arise from a de re as opposed to the de se reading of the coordination clause.

2.1.2 Partial Homomorphisms

The main challenge in the setting up a compositional semantics should address the issue of whether the homomorphic relation between syntax and semantics is partial or complete. The issue has not been central in the debates, but a considerable number of works have based their systems of some form of partiality (cf. Hodges, 2001, Muskens, 1995). Kracht (2003) considers partiality to ensue from grounds of ignorance, individuals do not have the complete epistemic content, or undefinedness in the determination of the truth values of propositions (closed statements).Muskens (1995) partializes Montague Semantics by replacing it with an intensional logic that consists of a partial possible worlds ordered by a part-of relation. He however does not do the same for the syntax, this is effected in Kracht (2003). Kracht (2003) in his introduction provides a basis for a partial interrelation between syntax and semantics, he holds that: '… algebras of exponents, categories and meanings are partial algebras, it is in general not possible to define a homomorphism from the algebra of structure terms into the algebra of signs. All we can get is a partial homomorphism (Kracht, 2003: introduction xi)'. The assumption of complete homorphism indicates a failure to recognize that even the modes of concatenatin posited, be they stipulated as merge mechanisms in generative grammars that are minimalist, are basically partial.

2.3 Graph Homomorphisms and Grammar

A tree (or grahical representation) T can be defined as a finite set B=B (T) of branches, together with a binary relation R = R(T) on B. tree representations can be given for both the syntax and semantics either autonomously or integrated into one. This depends squarely on how the syntax-semantics interface is stipulated. Besides, the idea of stipulating homomorphism as a tree is common in Generative grammars like the Chomskyian one, Tree Adjoining Grammars and constraint based grammars such as Headed Phrase Grammar (HPSG), and Lexical Functional Grammar (LFG). The notions graph homomorphisms in the grammars are implicit in the theoretical specifications provided in the modes of syntactic and semantic representations given in the grammars. One of the early responses

In the Generative grammar, the critcal theoretical construct that determines the form of trees (or graphs) is the costrual of the notion of binarity in grammatical representations by Kayne (1995). The tree structure limits the manner in which the nodes and their terminal elements are realized. However, there is no agreement on the manner of demonstrating the relation between syntax and semantics in the generative tradition. Lorhndal (2013) notes that the notion of transparency subsumed in relation to the syntax-semantics interface, that is, there may be a one to one correspondence in the mapping from syntactic to semantic rules. In directly compositional grammars (cf. Jacobson, 2002; 2007; 2014), it is held that syntax and semantics work together to generate expressions. These aspects fly in the face of the fact that displacement phenomenon shows that there is assymetry between the syntactic realization and the positions where they are interpreted which is still an accepted aspect in the theory. This renders any assumption of direct compositional algebraic systems that give support to the asssumption of some form of homomorphism problematic.

CONCLUSION

The use of the notion of complete homomorphism is considered to be metaphysically misconstrued, given

that the content of language is a partial encoding of reality, and the very mechanisms such as concatenation are partial operations. This paper therefore reccommends a re-examination of the algebraic systems behind the grammar formalisms that are used to effect the syntax-semantics interface in human languages.

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