Towards a Neutral Semantics

Manuel Rebuschi

Manuel Rebuschi
L.P.H.S. – Archives Henri Poincaré, UMR 7117
Université Nancy 2 (France)

Towards a Neutral Semantics

April 16, 2003

Professional address:

Manuel Rebuschi
LPHS – Archives Henri Poincaré
Université Nancy 2
23, Bd Albert 1er
BP 3397
F-54015 NANCY Cedex
France

Tel : (+33/0)3.83.96.70.82
Fax : (+33/0)3.83.96.70.83
E-mail : <manuel.rebuschi@univ-nancy2.fr>

TOWARDS A NEUTRAL SEMANTICS

April 16, 2003

ABSTRACT. The purpose of this paper is to show that procedural semantics should be thought of as independent from representational semantics. According to the standard representational view, semantics is expected to account for the relations that hold between language and reality. This conception, grounded in the universalistic tradition, is directly challenged by the dynamic turn that focuses on procedural semantics, i.e. on the way one understands the meaning of a discourse. The paper will concentrate on the special case of Hintikka's Game-Theoretical Semantics (GTS) and its enlightenment of several dynamic phenomena of natural language. It will be claimed that GTS should be reinterpreted as a procedural and non-committing, i.e. ontologically *neutral* semantics.

1. INTRODUCTION

Recent technical developments in formal semantics, particularly those triggered by the so-called *dynamic turn*, seem to require an update of our philosophical outlook on semantic matters. The aim of this paper is thus not to provide a new competing semantic theory, but to account for some philosophical implications of the current theories. As Dekker states, "the dynamic turn … raises a number of theoretical questions. In the first place there is the question to what extent old-fashioned concepts of static semantic systems [such as satisfaction and truth, rigid or demonstrative reference] can be retained, or may have to be re-assessed" (Dekker 1996: 2).

The main concern of this paper is that of the relationships holding between semantics and ontology. It will start (Section 2) with a distinction between two conceptions of semantics: (i) *representational semantics*, according to which semantic theories should account for the relations between language and reality and are thus ontologically committing, and (ii) *procedural semantics* that states that theories should deal with the way the users of a language understand a discourse, i.e. with the cognitive value of discourses.[1] It will be contended that semantics – viewed as procedural – should be emancipated from the strong meta-theoretical constraints imposed by the classical representational conception.

Logical games (Section 4) and dynamic semantics (Section 5) yield important expansions of classical logic and 'static' semantics, which should modify our picture of the standard Tarski-type models: they strongly urge us to adopt a renovated perspective on the nature of semantic values as (ontologically) *neutral* items. It will thus be argued that such a neutral conception of semantics better fits the model-theoretic tradition than the current realistic one.

For a great part, this paper will be a critical discussion of Hintikka's stimulating logical and philosophical ideas. Hintikka's technical contributions to model-theoretic and dynamic semantics are well known, as much as his realistic philosophy of logic. In spite of this, I will attempt to show that antirealism is a more natural and adequate conception for the semantical and logical theories he has himself created, than his own realism.

2. TWO CONCEPTIONS OF SEMANTICS

2.1. *Views of Semantics and Views of Language*

One can consider two conceptions of semantics: (i) a *representational* conception, according to which semantic theories account for the relations between language and reality, and (ii) a *procedural* view, according to which semantics should provide explanations of the language users' understanding of the meaning of sentences and discourses. According to the first view, semantics is

---

[1] I am greatly indebted to Jaakko Hintikka for this distinction between the two views of semantics.

ontologically committing in the sense of Quine: the semantic values of (at least) some of the expressions of the language belong to reality. Representational semantics therefore requires strong limitations on semantic theorizing. In contradistinction with this view, I will argue that procedural semantics should be built with no ontologically-oriented constraints, as a neutral semantics.

This contrast between two views of semantics can be compared to another distinction, due to Hintikka (1985, 1988), between two conceptions of language. According to Hintikka, there are two traditions in logic: the *universalistic tradition* and the *model-theoretic tradition*, respectively involving two rival views about language: *language-as-medium* vs. *language-as-calculus*. The universalistic tradition and the language-as-medium view hold that there is one unique (actual) world,[2] that language, as a universal medium, is already interpreted and inescapable, and that truth is therefore ineffable. By contrast, the model-theoretic tradition and the language-as-calculus conception allow many worlds (i.e. many reinterpretations of our language) and many languages, truth and the semantic relations in general being variable and expressible in some available metalanguage.[3]

The two distinctions are of course not the same. Nevertheless, they can be related in the following way: both representational semantics and universalism (or language-as-medium) imply a strong connection between semantics and ontology. To see this point, one has to depart from Hintikka's claim that the language-as-medium conception entails anti-realism, either epistemological or metaphysical (see Hintikka 1985). Epistemological anti-realism actually *is* a consequence of universalism: if one cannot escape the language, semantics, i.e. the knowledge of our (linguistic) means of knowledge, is, if not impossible, obviously quite limited. But as one postulates the unicity and invariability of our language and world, one is committed to *metaphysical realism*: since an (unique) interpretation structure precedes rather than follows our language, it can be nothing except the (unique) world. In the universalistic frame, semantic relations, model-theoretically conceived of as holding between a language and its multiple interpretations, are necessarily understood as relating the universal language to the world: what we speak about, hence what we know something about (possibly with some distortion), must be the (unique) world.

These considerations do not by themselves entail that the model-theoretic tradition should diverge from the representational ontologically-committing view of semantics. Actually, most of the semanticists or philosophers of the model-theoretic tradition take it for granted that semantics is representational or needs to be grounded on some representational semantics, as can be seen from the general agreement with Quine's criterion of ontological commitment (see Section 2.3 bellow).

However, recent developments of the model-theoretic tradition led to what is known as the dynamic turn in semantics. This turn entails an amplification of procedural semantics and raises the issue of its dependence on representational semantics. Indeed, it will be shown that several important dynamic phenomena cannot be accounted for if our procedural semantic theories rely on representational semantics or ontological considerations (Section 4). And the split between the two views of semantics through the dynamic turn is more general. Game-Theoretical Semantics (GTS), which belongs to the model-theoretic tradition and is also involved in the dynamic turn (see Gochet 2002), is usually conceived of as a representational theory but it entails some difficulties (see Section 3). Against the standard view, I will argue that GTS could and should be reinterpreted as a model of procedural semantics independent from ontological considerations.

The perspective presented in this paper can be summed up in he following way: the universalistic tradition involved an ontologically-committing conception of semantics which could expand to the model-theoretic tradition as long as it remained in the static frame; with the dynamic turn, we have

---

[2] This world may be divided into several parts, as in Frege's or Popper's ontology, and those parts may be called "worlds". What matters here is the confidence that one cannot escape that (those) actual world(s), or more accurately, the fact that Universalistic semantics does not consider non-actual worlds.

[3] The language-as-calculus view is thus *not* a conception of language as some uninterpreted calculus. By contrast with the language-as-medium view, the language-as-calculus allows a kind of external viewpoint on language, so that it make sense to reinterpret it and even to change our language.

to separate semantics from ontology, i.e. to separate procedural semantics from representational theories.

2.2. *Quine's Criterion and Meta Theoretical Constraints*

The representational view of semantics clearly dominates the origins of logical analysis. Actually, Frege's apprehension of semantics and Russell's are comparable in that, whatever specific theory is considered the best one, semantic correlates of at least singular expressions automatically carry some ontology about them. And according to many followers and commentators, after accurate regimentation not only singular terms, but also *every* expression of language, trigger an ontological commitment. In this received view, Frege and Russell seem to have admitted semantic correlates of general terms (concepts and sense of concepts, or Universals), and of sentences (truth-values, or Propositions), as ontologically relevant in the same manner as singular terms. Consequently, ontology exactly maps language as semantically theorized (and reciprocally): when semantics is dualistic, such as Frege's, the world splits into (at least) two parts (an intensional part and an extensional one);[4] if it is monistic, such as Russell's, one world is sufficient.

This 'ontologizing' understanding of semantics, which seems to have been shared by many after Frege and Russell if not by themselves, entails meta-theoretical choices throughout language analysis, e.g. the particularly intricate treatment of empty singular terms by Frege who wanted to avoid any commitment to fictional entities. Russell's drastic reduction of the category of genuine singular terms, though connected to epistemic features, follows the same tack, as do contemporary 'neo-Russellian' criticisms of the legitimacy of individual concepts.

At odds with Frege and Russell, Quine explicitly restricts ontological commitment to *one* syntactic category, namely *variables*. His strategy enables one to use predicates and to assert sentences without being committed to platonic objects such as Universals or Propositions; therefore, Quine's account may look somewhat like nominalism, although it is still full-fledged realism about particulars. Thanks to Quine's accordance with universalism, such syntactically delimited ontology is still conceived of as genuine ontology: as there is *one* language – first-order logic being the canonical language of regimentation of science – and *one* world – see Quine's disinterest in model-theory, or his rejection of modal logic –, language is always related to reality. The restriction of ontological commitment to variables does thus not imply any shift from the classical view of semantics as representational.

After the so-called 'linguistic turn' in philosophy, Quine's conception of ontology and of (extensional) semantics became the most prominent framework for different families of metaphysical realists, who consider some or all of the semantic items as *bona fide*, i.e. ontologically relevant, objects. Moreover, technical issues within logical semantics such as the status of individual concepts are generally challenged while presupposing Quine's criterion. It should yet be noticed that Quine never claimed to account for linguistic meaning, a notion he held to be suspicious, and that his regimentation explicitly parts from sense-preservation or synonymy (Quine 1960, §33).

Quine's support for universalistic ideas actually entails a strong connection between logic and ontology, whereas the implicated meta-theoretical constraints seem to have forced him to depart from a complete explication of natural language semantics (and from a great part of technical logic progress). The universalistic conception of semantics thus appears to be *strongly normative*, since *what there (presumably) is* intervenes as a coercion through language analysis, and leads to revisionist strategies. To put it in a nutshell: Quine's conception implies that ontological considerations come first, and that semantic theories (an particularly procedural semantics) should adapt or die.

---

[4] Each part may split again according to syntactic categories (singular terms, general terms, sentences). Moreover, Frege's ontology adds another world, corresponding to the connotative or 'subjective' aspects of language (which are not accounted for by its semantics).

2.3. *Quine's Criterion Expanded: Model Realism*

[1] Although occupying for a time "a middle position between [the] two conceptions of language" (Niiniluoto 1997: 18), Tarski eventually opened new perspectives in and *on* semantics. His systematic meta-theoretical approach to semantics entails, by itself, the possibility of language-shifts; going further, model theory allows world-shifts, i.e. reinterpretations of language.

The expansion of Quine's criterion to the new model-theoretic frame leads one to identify ontology with the domain of an interpretation structure of a formalized language; for modal logic and its semantics, ontology so conceived is composed of 'possible objects' located in 'possible worlds'. Such identification may be labeled as Model-Realism (hereafter, MR). Though inherited from universalism, MR seems to be the dominant position since Tarski's semantic turn; according to this view, semantics should consist of (or depend on) representational theories.

Let us call that language-and-semantics-relative 'ontology' – i.e. the constituents of the domain(s) of a structure – the Technical Semantic Ontology (hereafter, TSO). Does it make sense to think of TSO as genuine *ontology*, i.e. as *what there is*?[5] It seems intuitively that if one expects it to make sense, one needs to choose *a single* language and *a single* semantic interpretation of that language as the best ones.[6] In other words, TSO seems to be genuine ontology… if we choose to go back to universalism.

At first glance, Tarski-type semantics looks as if it could explain the genuine relation holding between (some) language and (some) world. It looks as if it could explain truth as a correspondence between language and world (regimented as an interpretation structure). It may – and did – consequently reinforce the 'ontologizing' conception of semantics advocated by Quine's criterion.

At the same time, Tarski-type semantics allows natural and straightforward solutions for issues raised within Fregean and Russellian semantics, such as the problem of empty singular terms. For instance, in order to provide a truth-functional semantics for fiction, one can easily quantify over a domain of fictional objects; whether one favors direct-referential vs. descriptivist theories, the very same domain can provide (fictional) 'referents' for (fictional) proper names conceived as rigid designators. Does such a tolerance imply any ontological commitment to fictional entities? If Quine's criterion is to be carried over to model theory, TSO (here 'fictional objects') will then constitute a genuine ontology. Semanticists should consequently either assume some very liberal and luxuriant ontology – taking fictional entities at face value –, or attempt to avoid this commitment by some theoretical revision. The same goes for possible-worlds semantics according to whether one is willing to commit oneself to 'possible objects' or not.

Ontology-oriented or representational semantics again appears to impose strong constraints on theories. It is embodied in the meta-theoretical choice to split usual singular terms into two categories in line with ontology.[7] In spite of (possible) appearances, a descriptivist Russell-like understanding of usual proper names is no exception to the rule: if a definite description is vacuous and occupies a subject position, the whole sentence is systematically false and therefore entails lots of unintended consequences.

[2] Such a complication of semantic theories is already questionable. I also think it is illegitimate. A strong argument in favor of non-committing semantics – i.e. against MR – is the *theoretical*

---

[5] In Carnap's words (1950), the issue is to know whether *internal questions* of existence should be identified with *external questions.*

[6] In the same way for instance that Quine avoids semantic variability: he roughly rules out possible (non-actual) worlds, and chooses the holistic language of science.

[7] The boundary between those two categories may fluctuate from one philosopher to another. An extreme case is that of the advocates of genuine "non-existent objects": they reduce the class of genuinely vacuous singular terms to the empty class.

uniformity it allows.[8] It is not sufficient by itself but can be warranted on methodological grounds, as follows.

In his criticisms of Donnellan's seminal paper about descriptive and referential uses of descriptions, Kripke (1977) argues for "unitary theories" against "theories that postulate [semantic] ambiguity", if the alleged ambiguity is not expected "to be disambiguated by separate and unrelated words in some other language"; so, against Donnellan's conception of semantic values shifting with uses of description, Kripke favors an account "on pragmatic grounds, encapsulated in the distinction between speaker's reference and semantic reference" (*op.cit.*: 3c).

While splitting usual singular terms into two classes according to (some presumed) ontology, Model-Realists postulate a kind of (superfluous) linguistic ambiguity: semantic values of expressions are supposed to shift with mutations in *presumed* ontology. For example, the same usual proper name 'Santa Claus', as used by a believing child or by his skeptical parents, would have different *semantic* interpretations.[9]

As far as semantic theories are concerned with *linguistic meaning*, it is quite amazing to postulate shifts of values with changes of (ontological) *beliefs.*[10] In fact, the distinction between these two uses cannot be adequately captured by Tarski-type semantics. What happens, for instance, when the parents and their child speak together of 'Santa Claus'? How can non-believers *refer* to a non-existent? Of course they cannot: they can only *pretend* to refer. But if they want to teach the myth as a true story they can, and even need to share their child's belief object, namely the semantic value he or she assigns to the mythical name. In other word, whenever veraciously speaking about 'Santa Claus', in a fictional or serious manner, one needs to postulate a genuine *semantic* (if not ontological) correlate for that name. Fictionally or seriously (believed) uses of singular terms and their related speech acts, pretended or genuine reference, need not and cannot penetrate into semantics. As Recanati puts it, "the difference does not matter from a strictly linguistic point of view. For we use the same linguistic material, with the same linguistic meaning, whether we genuinely refer or only pretend to refer. This follows from the very notion of 'pretense'." (1996: 467).

[3] By contrast, an ontologically-neutral conception of semantics would allow many choices forbidden to model-realists so that our (procedural) theories suitably account for our linguistic intuitions. According to the neutral view, semantics only targets modeling linguistic meaning, whatever the world may be. Expressed in the Quinian idiom: the neutral view leads to a *naturalization of semantics*, and to an anti-revisionist strategy.

Focusing on the cognitive value of *any* usual proper name (empty or not), a naturalized conception of semantics will naturally favor some uniform analysis and account for the aforementioned case of 'Santa Claus' in a child's way. With this broad (ontologically) neutral view, what is expected from theories is a meaningful account of the contribution of contextual domains of discourse to the semantics of sentences: ontological considerations about the status of domains are beyond their subject matter. If a theory targets a true description of linguistic meaning, whatever the ontology, it needs no artificial (metaphysical) meta-theoretical constraints on the constitution of

---

[8] As a proponent of a maximally liberal ontology, Zalta rightly insists on this point: "Once we are able to see that all significant proper names are names of objects, we may simplify the Tarski-style definition of truth for languages in which names of nonexistents appear along with names of existents. The truth conditions may be specified more systematically, since no special precautions need to be taken to distinguish the two kinds of names". (Zalta 1984: 2) (In return, his support for MR forces him to account for a general "metaphysics of object", including nonexistents.)

[9] Moreover, MR leads to the counterintuitive upshot that historical discoveries – e.g. some confirmation of the conjecture that Homer never existed – amount to some *semantic* change. This may be related to the interpretation of scientific discoveries as meaning shifts: Putnam (1975) interestingly notices that this conception is connected with strong anti-realism, for it conceives of reality as depending on our current scientific theories. It then turns out that Model-Realism, i.e. the 'ontologizing' conception of semantics transposed in the model-theoretic tradition, leads to metaphysical anti-realism.

[10] This contradicts our pre-theoretical notion of linguistic meaning; cf. Evans (1982: 23-24).

TSO: neutral semantics is hence characterized by a kind of meta-theoretical freedom, which is accurately in accordance with the model-theoretic tradition.

TSO variability ('ontological relativity'), as it is induced by model theory, needs not be restricted. Defined as relative to a structure, the Tarskian concept of truth should not be thought of as the universalistic, absolute one. Nor should one consider such and such TSO as composed of *bona fide* objects. MR appears thus to be a coarse transposition of the universalistic outlook to a frame where it becomes senseless.

Why did courses-of-values still remain ontologically relevant according to logicians after Tarski? It may *prima facie* seem to be an historical enigma, but (at least) two conditions were probably not fit for giving up Quine's criterion, even if a neutral conception of semantics is the most adequate philosophy for the newly fashioned model-theoretic tradition: (1) whenever one does not want to convert to radical anti-realism, one needs to give a semantic-independent account of *reference*,[11] and (2) one also needs to give a philosophical account of semantic values as allegedly irrelevant for ontology. I will later argue that all what is required is that these values play their intended role in procedural semantics.

3. GAME-THEORETICAL SEMANTICS: PHILOSOPHICAL SCOPE

As it is based on models, Hintikka's GTS incontrovertibly belongs to the model-theoretic tradition. In this section it will be shown that GTS and IF logic entail puzzling issues as long as they are conceived of according to the MR conception. Against Hintikka's own realistic conception, I will thus argue for a reinterpretation of GTS as a neutral (procedural) semantics.

3.1. *Introduction*

According to GTS, sentences are evaluated through games played by two ideal players, relatively to some given model. An existential statement, e.g. '$\exists n\, P(n)$', is true in a model if and only if the (initial) Verifier – or "Myself", or "Eloise" – has a winning strategy to single out an object from the domain of the model, say a, such that the atomic sentence '$P(a)$' is true. On the other hand, a universal statement, e.g. '$\forall n\, Q(n)$', is false in the model if and only if the second player, the (initial) Falsifier – or "Nature", or "Abelard" – has a winning strategy to pick up an object, say b, such that '$Q(b)$' is false.

Games of "seeking and finding" or *semantical games* hence provide a basis for shifting meanings of quantifiers. For instance, one can restrict the set of available strategies to recursive functions in order to account for some constructive conception of quantifiers, which would correlatively restrict the class of corresponding "models". GTS thus supplies a general framework within which one can produce semantic (or logical) changes, and which therefore plainly fits the language-as-calculus viewpoint. Tarski-type semantics appears to be one singular interpretation of the new frame: it amounts to semantical games with no restriction on the winning strategies.

Moreover, GTS leads to a natural extension of classical first-order logic as one conceives of the possibility of games with *imperfect information*. For example, let us consider the game corresponding to the formula '$\forall y\, \exists x\, S[x, y]$' when the Verifier doesn't know the Falsifier's preceding move (the choice of the value of y) as she chooses the value of x. With the introduction of a single new item of notation, the slash '/', mutual informational independence of quantifiers (and of connectives) can be expressed in the logical language. An example is provided by the case mentioned above, whose reformulation will be '$\forall y\, (\exists x/\forall y)\, S[x, y]$', where '$(\exists x/\forall y)$' expresses the independence of the existential quantification from the universal one.

---

[11] Within a neutral semantics frame, this first issue is expected to be performed at an extra-semantic, i.e. *pragmatic* level.

The new logic, *independence-friendly* (IF) *first-order logic*, has several interesting properties (see Hintikka 1996: 65). It is more expressive than classical first-order logic.[12] Tarski-type semantics is irrelevant for IF first-order languages whereas GTS is perfectly adequate. Furthermore, IF first-order logic looses a presumably important property of classical first-order logic: *semantic completeness*; in other words, IF first-order logic does not admit of a complete axiomatization.[13]

3.2. *Two Puzzling Issues for GTS and IF Languages*

Let's now return to our main issue: does the ontological commitment of (quantified) variables make sense in the model-theoretic tradition? Hintikka thinks it does,[14] and his conception is an explicitly adopted form of radical realism (MR): actual concrete or abstract objects, possible objects, even fictional objects (Hintikka 1984: 452) equally belong to the genuine ontology whenever they are selected as values of variables. I will now argue that MR, although Hintikka advocates it, directly contradicts the burden of his own account to the development of the new tradition.[15] Hintikka is to be thought of as Hegel: he yielded many arms for a conceptual revolution, but maintained an old-fashioned transcendental Reality that stopped him in his movement.

Hintikka (1988) is right insofar as he conceives of GTS and IF first-order logic as *natural* developments or expansions of 'classical' model theory. Several features of the game-theoretical approach, concerning formal languages, have been briefly surveyed in the preceding subsection, and some others, regarding natural language semantics, will be shortly examined in the next section. In comparison with standard (Tarskian) semantics and standard (Fregean) logic, GTS and IF first-order logic generally yield more expressive languages and more powerful semantics. Admittedly, they increase the semantic variability generally pointed out as a typical feature of the underlying language-as-calculus conception of the Model-theoretic tradition. Therefore, the game-theoretical approach should refine the new (model-theoretical) paradigmatic depiction, if any, of logical and semantical subject matters.

[1] *Truth.* IF first-order languages have a very interesting – and *prima facie* extraordinary – property: they (at least some of them) can contain their own truth-predicate (see Hintikka 1998). Roughly said, this is due to the fact that the GTS truth-conditions of a sentence *S* are expressed by the existential statement of a winning strategy (i.e. a Skolem function) for the initial Verifier, i.e. a

---

[12] Some formulae, such as those involving branching quantifiers – e.g. '$\forall x \; \forall z \; (\exists y/\forall x) \; (\exists u/\forall z) \; S[x, y, z, u]$' – cannot be expressed in the classical notation, i.e. without the slash-notation. – The expressive power of IF first-order logic can be explained by an unrestricted resort to all the functions definable over some given domain: the same kind of assumption leads to the standard semantics for second-order logic (I thank an anonymous reviewer for emphasizing the latter point).

[13] IF first-order logic is equivalent to the Σ_1^1 fragment of second-order logic, i.e. every Σ_1^1 second-order sentence can be

translated into some IF first-order language. Such a fragment is –as second-order logic– semantically incomplete, but according to Hintikka it provides a better tool for developing model theory since it carries no commitment to (dubious) entities such as sets.

[14] Hintikka (1985) states both that Universalism damaged metaphysical realism, and that the model-theoretic viewpoint should rehabilitate it. I emphasized before that Hintikka's conception of universalistic antirealism is misleading. I now turn to the alleged compatibility of realism with model theory.

[15] Puntel (2001) explores the connections between semantic compositionality and ontology: he convincingly argues that an ontology of *objects* is essentially related to the (usually presumed) sentential compositionality of semantics and, as he advocates a "strong version" of the Context Principle incompatible with such a type of compositionality, puts forward an alternative ontology of elementary *states of affairs*. Puntel's argument is restricted to the (non-)compositionality of atomic sentences, so that it does not affect GTS – whose basis for atomic sentences is compositional, then genuinely *objectual*, even though GTS is globally non-compositional. However, the reasoning sketched out in this section is analogous to that of Puntel for it is also about the effects on ontology of some characteristics of semantical theories. I won't claim that GTS and IF logic enforce to reject an objectual ontology (TSO), but that within the game-theoretical framework one has to 'desubstantialize' these 'objects'.

Σ_1^1 form, that can hence be translated into IF languages. Such a correspondence between the language and its metalanguage is of course unavailable for standard first-order logic. Thanks to IF first-order logic, Tarski's hierarchy of metalanguages is no more required to describe the relations holding between a language and its models: this can be achieved from inside. As Hintikka says: "Far from being ineffable, the notion of truth is inescapable" (Hintikka 2001: 34).

However, the definability of truth for a given (IF first-order) language in that very language, together with MR, raises puzzling issues. If models are to capture genuine (parts of) reality (MR), IF first-order logic enables one then to grasp neither more nor less than God's panoramic viewpoint on language-world relations! This upshot is, at least implicitly, assumed by Hintikka as the real significance of our exit from universalism: since we can now change our languages in accordance with our goals, notably for a study of language itself, semantics is no more ineffable, and epistemological antirealism is ruled out once and for all (cf. Hintikka 1985).

Such a striking consequence is not to be relativized to formal languages: as Hintikka considers that IF first-order logic is our natural logic, truth is expected to be definable within natural language. If we are led to formulate semantical paradoxes such as the Liar's, their apparent threat is only due to the fact that informational independence, as a transcategorial phenomenon, is syntactically silent, i.e. that there is no counterpart to the slash within the syntax of natural languages (Hintikka 1990).[16]

In the universalistic frame, the rejection of the simple possibility of God's viewpoint coincided with the conception of a unique, *ergo* inescapable, language. Following the same line of thought, Tarski did not expect his definition of truth, drawn for formalized languages, to expand to natural language, since the latter remained universal – no metalanguage can be constructed over it, hence no truth-definition can be expressed (Hintikka 1996: 17). To put the same point in different terms, the impossibility of God's viewpoint coincided with Tarski's inexpressibility of truth (and of the whole semantic apparatus) for a language in the very same language.

But coincidence is not *equivalence*: 'Post-Tarskian' truth and semantics, albeit expressible within the language, *do not* imply removing the highlighted epistemic limitation as an archaic universalistic prejudice. As Sluga states it: "we must assume that our talking is in some way or other responsible to the world. That is what *philosophical* attempts to explain the concept of truth have always been concerned with. And with respect to that issue the objections, worries, and difficulties that Frege, the early Moore and Russell, and the early Wittgenstein had, still remain." (Sluga 1997: 40). One of those objections, worries and difficulties, could be expressed – in a pragmatic style – as the impossibility of a complete knowledge of an instrument *qua instrument*. One cannot dispense with such a claim without any strong argument, and the so-called post-Tarskian truth cannot realize the task.

For one can maintain the claim together with the definability of truth within the language: one then needs to dispense with MR, that is, to consider the subject matter of semantics as purely internal to language, with no but pretended anchoring into the world.[17] Models can however be

---

[16] More accurately: the Liar paradox can be expressed in an IF-language, but thanks to the game-negation, it becomes innocuous. Indeed, some evaluation games may occur for which none of the players has a winning strategy; the corresponding sentences are thus neither true nor false. The Liar paradox is one of such undetermined sentences (see Hintikka 1996: 142.)

[17] Within a radically different theoretical framework, namely that of category theory, Landry accounts for a structuralist conception of mathematics while rejecting the assumption "that the only way one can use a statement to *talk about* objects is if the statement *is about* objects" (Landry 2001: 82). Using category theory "as an organizational tool for our analysis of the content and structure of what mathematical propositions say" (*Ibid.*: 79) enables her to achieve this task, thanks to a property analogous to the definability of truth in IF first-order logic, namely that:

> we can describe the content and structure of linguistic frameworks, i.e., of categories, in category-theoretic terms. We *can* account for the 'existence' of categories in terms of general categories, *without* having to invoke an object-language/meta-language distinction. … Category theory permits us to *talk about* categories, without our having to claim that it is *about* categories. … Thus, we can safely be internal semantic realists (realists on the basis of *what we can say* as warranted by the truth-conditions of the statements that are made from *within* a

apprehended as (possible) *representations* of the world, and the objects of TSO as (possible) *representatives* of some items of reality: an account of the true "representation" relation between models and reality goes far beyond the semantics business, and a systematic ontological commitment to representations *qua* representations would obviously be a nonsense.

This alternative to MR requires a refinement in our understanding of the new tradition: as the presumed invariability of universalistic language and semantics is (de facto) overshadowed by model-theoretic advances, there still remains a (de jure) irreducible perspective "from inside" correlated with the language-as-medium conception (see Peregrin 1999). This residue inherited from the old universalistic tradition does not conflict with the new model-theoretic one; on the contrary, it meets some pragmatic features of GTS and IF logic.

[2] *Quantifiers*. Hintikka insists that quantifiers can no longer be understood in a Fregean way, i.e. as second-order predicates. The new, game-theoretical framework provides a reformed conception of quantifiers as "embodying choice functions" (Hintikka and Sandu 1994: 114-115).

But as was already stressed, Hintikka simultaneously supports the old-fashioned criterion of ontological commitment. Yet Quine did actually criticize "the deviant quantification theory with its branching quantifiers", and noticed that with such deviancies "an ontological standard geared to classical quantification theory is overcritical" (Quine 1969: 162). In an IF first-order language, as one asserts the existence of an individual object, one asserts the truth-conditions of the sentence, i.e. the existence of a winning strategy (a choice function or Skolem function) since these truth-conditions are expressible in the same language by the very same sentence.[18] So, if there is to be any ontological commitment, is it to individuals or to individuals and functions? As combined with MR, the situation appears to be confusing. After Hintikka, I will however assume that the status of IF logic as a first-order logic is unquestionable. The values of quantifiers are undoubtedly individual objects, but these might be objects of a special kind.

On the other hand, GTS is presumed to unify truth-conditional and verificationist semantics (Hintikka 1987, 1996: 23). In fact, there is at least a tension between both directions, and although Hintikka chooses to ground his semantical theories in the former one, the new frame rather suggests choosing the latter. Rivenc (1998) highlights the fact that the verificationist understanding only commits itself to potential infinite, that is to the indefiniteness of the verification processes we are expected to achieve: these should be at most denumerable. As the Verifier's strategy must involve the *totality* of the Falsifier's possible moves, this totality should thus be at most denumerable too. Therefore, in order to obtain a truth-definition equivalent to the classical (Tarski-type) definition for some universally quantified sentence, one must *postulate* that the Falsifier can choose values beyond the denumerable. In other words: to obtain an equivalent to classical semantics, one must assume, i.e. incorporate into the game rules, that the universal quantifier has its classical meaning (Rivenc *op.cit.*: 161). This specific additional meaning appears to be simply regional in comparison with the universal viewpoint afforded by GTS.

GTS and IF logic provide a new and enlarged perspective on quantification and as such, they should modify our view of TSO. *To be the value of a (quantified) variable* is now more than to be in some given domain. Hintikka himself maintains that the meaning of quantifiers has two components: "An existential or universal quantifier does not receive its entire meaning from its variable's ranging over a class of values. There is another important component … [which] is constituted by the relations of dependence and independence between quantifiers." (Hintikka 2002:

---

linguistic framework) without having to make reference to categories-as-objects that exist in some meta-linguistic structure… (*Ibid.*: 91)

The denial of the distinction between different levels of language thus leads Landry to a position very similar to the one I defend in the present paper.

[18] Hand (1993: 428) argues against Quine that the same critics should apply to "the more familiar Tarskian semantics [for it] also gives rise to second-order ontology [with] the set-theoretical notion of a *sequence* of objects". This argument would be sound if it were to defend GTS as semantics for *classical* first-order logic. For a defense of IF first-order logic, it is irrelevant.

408). For an existential IF sentence to be true, it is not only required that there be an individual in the domain, but also that this individual be accessible to the Verifier through the evaluation game. The information flow of the game hence adds an irreducible procedural feature to representational semantics. To be the value of a variable now becomes *to be available in the evaluation (game) process*.

3.3. *Towards a Neutral GTS*

The considerations above suggest to emphasize what can be considered as the general dynamic and anti-realistic component of the game-theoretical frame, i.e. to take games and players at face value. According to Hintikka, semantical-games must be carefully distinguished from truth-seeking games: the former are truth-constituting, whereas the latter are based on them: "Coming to know that *S* is true means finding a winning strategy for [the correlated semantical] game" (Hintikka 1996: 35), and this presupposes that the meaning of *S* has been previously established. There is an obvious epistemic element in truth-seeking games, which Hintikka rightly wishes to eliminate from semantical-games. Yet his rejection of intuitionistic limitations in truth-definitions leads him to underestimate the genuine epistemic feature of semantical-games. It causes him to "stick to the letter of the definition" of truth as the *existence* of a winning strategy for the Verifier, and to depart from the "seriously misleading" formulation that the Verifier *has* a winning strategy: "There may exist a winning strategy for the initial verifier in the abstract sense of the existence of the relevant strategy function without any actual player being cognizant of it, or perhaps even without any player being able to know the winning strategy" (Hintikka 1996: 214). Yet the condemned formulation – which I used above – appears to be strictly equivalent: if the Verifier is assumed to be an *ideal* player with unlimited epistemic powers, she is then able to grasp whatever strategy is available in the game (even nonrecursive strategies, as in classical semantical-games). This formulation is indeed less committing than Hintikka's, for it emphasizes the verificationist or procedural feature of GTS.[19]

But we can go on further: an ideal player can behave in such-and-such a way, without any hypostatization of the *type* of behavior he or she instantiates. Hence the Verifier in a classical game can be thought of as an ideal player with unlimited epistemic powers, such as she knows *how* to win systematically the game.[20] As Martino puts it (in a different but very close context), an explanation of

… quantification in the object language assuming the notion of quantification over choices in the metalanguage … avoids any circularity and its importance rests on the fact that choices are not objects but *acts*. Any talk which reifies

---

[19] At odds with Hintikka, van Benthem claims to take seriously IF semantical-games *as games* and provides an interpretation of IF games as models for some epistemic languages. He states that:

> Imperfect information games can be analyzed in a dynamic epistemic language, making the knowledge and ignorance of players explicit. The advantage of this approach is that implicit assumptions about players' abilities become explicit, and we can cash out their role in reasoning about what players can do and know. (van Benthem, forthcoming: 12).

For instance, van Benthem's technical concept of a *strategy* differs from that of Hintikka (and is closer to game theory). Indeed, in the game associated with the IF first-order sentence '$(\forall x)(\exists y/\forall x)$ [$x \neq y$]', interpreted on a structure with two or more individuals in its universe, according to Hintikka *there is no* "winning strategy" for the initial verifier (so that the sentence is not true), whereas for van Benthem, the "Verifier … has a winning strategy" (even two: those that occur in the game associated with the classical sentence '$(\forall x)(\exists y)$ [$x \neq y$]'), "but it is not useable" (*ibid.*: 4) because she doesn't know which one it is. Hence what is required is "strategies which are not just winning, but ones for which players *know* they are winning" (*ibid.*: 9). Van Benthem's account then reveals many subtle epistemic features of (ideal) players implicitly present within IF first-order logic.

[20] This reformulation avoids any commitment to strategies, even as intended entities grasped by ideal players. It fits then the pragmatist requirement of Lorenzen's and Lorenz's dialogical games that the meaning of terms should be learnable within finite practice of single plays, that is without any quantification on strategies. A winning strategy for a player is thus reduced to the mere *possibility* of indefinitely many winning plays.

acts treating them as objects is to be paraphrasable, in principle, so to avoid any reification. In particular, quantification over acts is to be understood in a purely potential sense. … a winning strategy can be understood, without any reification, in terms of the notions of possibility and independence. (Martino 2001: 75-76).

Indeed, the *existence* of a *winning strategy* for the initial Verifier in the semantical-game associated with, e.g., '$(\forall x)(\exists y/\forall x) S[x, y]$', can be reformulated as the *possibility* that she singles out an object b, *independently* of the choice of a value a by the Falsifier, such that '$S[a, b]$' is true. As in IF first-order languages, asserting a sentence is equivalent to asserting its truth-conditions, it amounts to an assertion "in terms of the notions of possibility and independence" of some ideal players' actions, which are "to be thought of as *objective fact*[s]" (*ibid.*). Quine's ontological commitment criterion is thus *out of play*.

Finally, reinterpreting GTS as a kind of procedural semantics by taking games *as games* suggests to depart from any representational constraint and to improve the action powers of the players. As we will see in the next section, the evaluation process could change the domain by allowing the players to bring in some new individuals.

The game-theoretical approach hence requires a complete conceptual shift (or revolution?) in our apprehension of the values of variables: TSO is now to be thought of as a *ludic ontology*, made of *ludic objects.* As the possible values of GTS-quantified variables, *ludic objects* are neither more nor less than the required items for the continuation of the semantical-games correlated with the quantified sentences. Their presence (in TSO) is guaranteed by the postulated epistemic and action powers of the ideal players embodied in the semantical-game rules.

Model theory and its game-theoretical improvements indicate a radically renovated picture of logic and semantics, where no free place is left for MR. Hintikka himself states that the received relations between syntax, semantics and pragmatics should be reconsidered (1996: 42). However, I think that Hintikka does not go far enough along the way. He convincingly argues for a revision of the distinction between semantics and pragmatics, since GTS involves genuine pragmatic features, and he rightly insists that the semantical-games do not depend on "the human agents who implement these games", nor on the language users' "idiosyncrasies" (*ibid.*: 42-43). Yet, against Hintikka, it does not follow that one has to endorse realism in ontology: realism in truth-value, i.e. realism in games according to determinate rules should be enough, because it suffices to consider the *objective fact* that such and such player *can win* such and such game.[21]

4. DYNAMIC SEMANTICS

Let us now look at natural language. What is the target of logical semantics if ontology and anchoring in the world are lost? What is the real function and meaning of *truth* in such a conception? I will argue that truth-value-based semantical theories account for natural valid schemata, those involved in the usual linguistic practice. Particularly interesting cases are those of anaphora, and I will examine three of them where ontological 'normative' constraints appear to be misleading. A totally dynamic conception of language is indeed necessary to explain such semantical topics.

4.1. *Standard GTS, Empty Names and Descriptions*

Thanks to its dynamic component, GTS is able to perform important task in issues about anaphora: semantical-games, which correspond to discourses, are broken up in several successive sub-games,

---

[21] The idea of winning a game without any commitment to the objects of the domain is certainly surprising. However, as we will see in the next section, games in extensive form enable one to separate the evaluation process from the intended interpretation: the existence of a winning strategy can be sketched without resort to any underlying model.

according to the order of sentences. Nonetheless, it will be shown that standard representational GTS cannot get round several important obstacles.

[1] *Empty Singular Terms.* Hintikka's and Kulas's analysis of anaphora stipulates a contextually defined set – or *choice set* –, say I, where individuals are introduced by the players of semantical games before the anaphoric pronoun is processed; the latter is then interpreted as a definite description that takes its value in I. Thus in the following example:

> (1) John walks in the park. He whistles.

the anaphoric pronoun 'he' succeeds to refer to the value of 'John' for it has been previously introduced in I, whereas

> (2) *John walks in the park. She whistles.

cannot have an anaphoric interpretation because 'she' is expected to depict a female individual and none has been previously introduced in I, like

> (3) *He whistles. John walks in the park.

where 'he' fails to refer since the choice set is empty before the utterance of the second sentence.

  Let us now consider the following successive sentences:

> (4) S. Cinderella smiles (S_1). She is beautiful (S_2).

where the proper name 'Cinderella' is the well-known fictional *ergo* empty singular term. It is expected that an account of anaphora apply to (4), and not to the following cases:

> (5) *Cinderella smiles. He is beautiful.
> (6) *She is beautiful. Cinderella smiles.

  The fact that 'she' is a successful anaphoric pronoun in (4) leads to anti-realistic conclusions. In Sandu's formalization of Game-Theoretical Semantics of anaphora (Sandu 1997), the success of (4) means that there is a winning strategy for the initial Verifier (Myself) in the semantical-game $G(M, g, S, I)$ associated with S in a model M, relatively to an assignment g (restricted to the free variables of S), and to the contextual set I ($= \varnothing$). So there is a winning strategy for Myself in the game $G(M, \varnothing, S, \varnothing)$. This is a conjunctive game, equivalent to the ordered conjunction of two sub-games, (G_1 ; G_2), where G_1 is $G(M, \varnothing, S_1, \varnothing)$, and where G_2 is $G(M, \varnothing, S_2, \text{Ind}^M(G_1))$, $\text{Ind}^M(G_1)$ is the set of individuals introduced by Myself during the first sub-game G_1. Myself has thus a winning strategy for G_1, which is analyzed as a choice followed by a game: (Ms:F(Cinderella)$\widehat{\ }G(M, \{(x, F(\text{Cinderella}))\}$, Smiles($x$), $\varnothing$)), where (Ms:a)$\widehat{\ }G_i$ is the game G_i preceded by Myself's (Ms) introduction of an object a, and F is the usual interpretation function in M. It means that the individual F(Cinderella) is picked up by Myself in the domain of the model. As the initial Falsifier (Nature) does not act during G_1, Myself has a winning strategy if and only if Myself can choose an individual in the domain of the model, namely Cinderella, if she ever smiles.[22]

---

[22] "… a pronoun h occurring in a sentence S may have a cross-sentential anaphorical relation to a noun phrase NP occurring in another sentence S' if [and] only if the individual which was introduced as the value of NP belongs to I. But … an individual is in I if and only if it has been chosen by Myself earlier in the game. Hence the cross sentential anaphorical relation between h and NP is possible if and only if there is an individual which is chosen by Myself as the value of NP in the game." (Sandu 1997: 165).

An advocate of MR, not willing to commit to fictional characters, might decide that the initial Verifier automatically looses the game (G_1 ; G_2), for F(Cinderella) is empty. But such a stance would artificially lead one to consider that GTS *fails* to account for anaphora on example (4), whereas if one admits that 'Cinderella' designates an object of the domain of M, GTS is perfectly adequate. MR would thus, once again, impose strong and unwarranted constraints on the semantical theorization.

Moreover, if a Model-Realist eventually chooses to commit himself or herself to fictional entities so that GTS is rescued, then other problems arise: Wettstein emphasizes that the pragmatic distinction between reference failure and successful reference to non-existent objects collapse with such a Meinong-like liberalization. He invites us to consider a dialogue between a patient and his psychotherapist:

> (7) Jones (hallucinating) : 'Look at that beautiful woman.'
> (8) Dr. Himmelfarb (his psychotherapist) : 'What does she look like ?'

and comments:

Jones uses a singular term 'that beautiful woman' intending to refer to what he thinks he sees across the room. Himmelfarb recognizes that there is no such woman and so does not utter his singular term, 'she', with the same sort of intention. Since there is no woman there, Jone's referential intention is thwarted. The lack of a real woman, however, presents no problem for the fulfillment of Himmelfarb's intention. … The first speaker … intends to refer to an existing entity. The second speaker's pronoun is anaphoric. Yet the second speaker does not intend to speak of an existing thing. How can this be? If the pronoun is anaphoric, moreover, and its antecedent fails to refer, the anaphoric pronoun itself must fail to refer. How then can we account for the second speaker's evident success?… The second speaker utters an anaphoric pronoun and since its antecedent fails to refer, his success… cannot consist in a successful *reference*. He, at the same time, does not 'fail to refer', at least not in the same sense as does the first speaker, since he does not even try to refer. Rather, he uses a singular term *as if* he intended to refer to the first speaker's intended referent. (Wettstein 1984: 441-443).

If GTS were to account for *reference*, as MR and more generally representational semantics entails it, Jones's failure in (7) would imply that no individual be introduced in the contextual set I, since the interpretation function cannot pick up any value for the description 'that beautiful woman' in the (realistic) domain of M. But if GTS is supposed to account for successful reference to fictional entities, as in (8), then the set I needs to be previously filled with an entity of the domain. So the verifier of the game correlated with Jones's utterance must have introduced this entity, and Jones did not fail to refer.

Recanati (2000: §15) proposes a "Pretense-Theoretic Perspective" for an account of the ascription of singular beliefs or pseudo-beliefs to speakers like Jones, which ensures a distinction between fictional and serious beliefs. This proposal does not yet locate the distinction at a semantic level, but at a pragmatic one. The "Meinongian pretense" induces a "context-shifting" that allows Dr. Himmelfarb to do *as if* there were a woman in the room, and to use the anaphoric pronoun 'she' successfully.

The success of anaphora in cases such as (4) and (7)-(8) would thus lead us to reevaluate the nature of the 'interpretation function' F: it should substantially shift the context, i.e. modify the model M by the creation of new objects in the domain. Among the winning strategies of the initial Verifier for a semantical-game, *finding* an object appears to be too restrictive: the ability of *creating* objects is required. But this leads to a procedural interpretation of GTS.

[2]. *Indefinite Descriptions ('Donkey Sentences')*. Let us now consider the following well-known examples:

> (9) A farmer owns a donkey. He beats it.
> (10) A goddess has a daughter. She smiles at her.

A GTS account of donkey-sentences such as (9) is similar to that of (1): usual proper names, definite and indefinite descriptions are – rightly – uniformly processed, since their semantic roles towards anaphoric phenomena are equivalent.[23] GTS can thus deal with those sentences that typically invalidate classical Tarski-type semantics. Roughly said, this is due to the fact that within successive sentences such as (9), the variable corresponding to the anaphoric pronoun 'he' is semantically bounded by the (existential) quantifier occurring in the preceding sentence, and is simultaneously a syntactically free variable; there is hence an overlap of two distinct notions of *scope*, a geographical one and a logical one, which standard semantics cannot deal with, whereas GTS can successfully do the job.

Yet as for (4), GTS together with MR lead to reject (10) as a genuine anaphoric case so far as there is no goddess (and no goddess's daughter) in the domain of the interpretation, although a neutral conception of semantics would allow to integrate it in a natural way.

Furthermore, GTS cannot discriminate between the following two examples:

> (11) If a goddess comes into the room, she will smile.
> (12) If a Smurf drives a car, it will be a blue one.

Indeed both of them are trivially resolved in the same manner, although they have obviously different meanings.[24] The upshot here is the same as Russell's analysis of conditionals, where the subject position of the antecedent is filled with an empty description: the antecedent is false, thus the whole sentence is trivially true. Standard GTS will consider as equivalently successful the pseudo-anaphoric relation in the following sentence:

> (13) *If a goddess comes into the room, he will smile.

[3] *Attributive and Referential Uses of Descriptions*. Earlier I mentioned Kripke's criticism of Donnellan's semantical account of the distinction between uses of descriptions: since there is no syntactical difference, Kripke (1977) claims that it should be processed at a pragmatic level, together with a *unitary* semantical theory. Kripke convincingly argues that Donnellan's account of the referential use of definite descriptions is not incompatible with Russell's theory, since Donnellan does not state "that 'Her husband is kind to her,' uttered in reference to the kind lover of a woman married to a cruel husband, express[es a] literal truth." (*op.cit*.: §.3c). Asserting that the description 'her husband', used referentially to designate an individual (her lover) that does not fill the description, leads to a true sentence, would be asserting non-Russellian truth-conditions for this sentence (*ibid*.: §.3a). Against Donnellan and Kripke, I would like to claim that such non-Russellian truth-conditions should, at least sometimes, apply to definite descriptions both in referential *and* attributive uses.[25]

Let us consider the following dialogue:

---

[23] The GTS game-rules for proper names and for "some" are equivalent (see Sandu 1997: 161).

[24] Natural language conditionals ($\Rightarrow$) have corresponding rules different from those of formal conditionals ($\rightarrow$), because the assertion of a conditional 'If A then B' does not amount to that of '$\neg A \vee B$'. Relatively to a model M, Hintikka and Sandu provide the following rule: "(**R. cond**). If $G_0 = G$(If S_1 then S_2; M), the players first play $G(S_1 ; M)$ with their roles reversed. If Myself wins $G(S_1 ; M)$, she wins G_0. If Nature wins, the players move to play $G(S_2 ; M)$ (with their normal roles). In this subgame, Myself has access to Nature's strategy in $G(S_1 ; M)$. The player who wins $G(S_2 ; M)$ wins G_0. The 'access' mentioned here can be defined as membership of the strategy functions Nature used in $G(S_1 ; M)$ in the choice set of the hole game." (Hintikka, Sandu 1997 : 392) Sandu (1997 : 160) yields a more complex (but equivalent) formulation. As the extension of both 'goddess' and 'Smurf' are empty, Nature automatically loses the first sub-game, $G(S_1 ; M)$, so Myself wins G_0. The natural conditional is therefore not clearly distinguishable from the formal one.

[25] I agree with Kripke's requirement of semantical uniformity, as well as with Donnellan's intuition that descriptions when referentially used cannot be correctly accounted for by Russell's truth-conditions. This intuition needs however to be clearly assumed as such, and extended to the attributive use of definite descriptions.

(14) *Dialogue*
　　A. "Mary's husband is kind to her."
　　B. "Yes, and he is undoubtedly rich."

The issue is to account for the anaphoric pronoun 'he', whose antecedent is 'Mary's husband'. In both uses, anaphora resolution succeeds even though no individual adequately fits the description 'Mary's husband'. On the other hand, the anaphoric linking would fail if A's and B's utterances occurred in a reverse order, or if B used 'it' instead of 'he'.

According to GTS, an object (put by Myself into the choice set during the game $G(A)$) is hence needed to allow the anaphoric relation to hold, i.e. the discourse process to go on. Kripke's requirement of semantical uniformity would thus be ensured: used referentially, 'her husband' will bring in the speaker's referent, whereas used attributively, it will bring some possible (perhaps non-existent) semantic referent. But of course, this solution is incompatible with GTS conceived of as a representational theory.

4.2. DRT and GTS

GTS is not the only 'dynamic' semantical theory on the market: Kamp's Discourse Representation Theory (DRT) and Groenendijk and Stokhof's Dynamic Predicate Logic (DPL) also claim to deal successfully with issues like those presented in the last subsection. I will concentrate on the comparative merits of GTS and DRT that can highlight my main theme, i.e. the presumed ontological commitment brought about by semantics.

[1] The analysis of anaphora yielded by DRT is in a quite better position to deal with such puzzling cases, even for MR advocates. DRT indeed adds a 'representational' level to the model-theoretic one, made of Discourse Representation Structures (DRSs), so that one can add discourse referents independently of the presence of a corresponding entity in the domain of the interpretation model. Hence unlike GTS, DRT does not process the anaphoric relation as if it were a co-reference phenomenon: the ontological neutrality of DRSs allows accounting for anaphoric relations even in cases where there is a lack of reference.

The supplementary representational level of DRT regiments some contextual information, e.g. the order of sentences, that do not appear in the model-theoretic interpretation of discourses. A DRS K is an ordered pair $\langle U, C \rangle$ composed of a *universe U*, i.e. a set of *representatives* (*discourse referents*, or *reference markers*), and of a set C of *conditions*, namely the properties and relations ascribed to reference markers. For instance, in the discourse:

(15) A man walks in the park. He whistles.

the first sentence provides the DRS K_1:

(16) K_1. $\langle \{x\}, \{\text{Man}(x), \text{Walks-in-the-park}(x)\} \rangle$

which is a kind of "model" of the situation described by the sentence (Eijck and Kamp 1997: 284). K_1 supplies the context for further analysis: as the reference marker x has been (automatically) introduced in the universe, it is now available as an antecedent for anaphoric pronouns. The interpretation of the second sentence of (15) yields a new DRS, K_2:

(17) K_2. $\langle \{x, y\}, \{\text{Man}(x), \text{Walks-in-the-park}(x), \text{Whistles}(y), y = x\} \rangle$

in the universe of which the anaphoric pronoun introduces a new reference marker, y, that can be identified with x. If the sentences of (15) are reversed, the failure of anaphora is then expressed by

the fact that the marker introduced by 'he' cannot be identified with any other available discourse referent.

A DRT analysis of conditionals provides the same successful results: the DRS associated with (11) is divided into two sub-DRSs:

$$(18)\ K.\langle\ \varnothing, K_1 \Rightarrow K_2\rangle, \text{with } K_1.\langle\{x\}, \{\text{Goddess}(x), \text{Comes}(x)\}\rangle, K_2.\langle\varnothing, \{\text{Smiles}(x)\}\rangle$$

where the universe $\{x\}$ of the antecedent K_1 is available from the consequent DRS K_2.[26] The process is similar to the corresponding decomposition of games by standard GTS, but DRT provides a more fine-grained approach: DRSs associated with (11) and (12) are clearly distinct, and a failure of anaphora such as in (13) can obviously be avoided.

[2] Just as in the case of indefinite descriptions, DRT seems to be more suitable than standard GTS for the analysis of (4)–(8) and (14). However, my purpose is not to select 'the best theory' for a technical account of anaphora. My main point is to account for a viewpoint on semantical matters that would be in accordance with the recent technical developments yielded within the model-theoretic tradition, namely by dynamic semantics: it is not a matter of semantics, but of philosophy. Thanks to the ontological neutrality of its 'representational level', DRT can help to provide such an account.

As it processes *every* singular term, DRT systematically introduces a discourse referent into the universe of the corresponding DRS. In other words, the denotation of singular terms is automatically *presupposed* to exist. For instance, because most of the usual definite descriptions are incomplete, they are treated like anaphoric expressions: an antecedent is thus expected in the context of the utterance, i.e. a reference marker available from the DRS, so that the marker of the description can be identified with it. What happens if no marker was previously introduced? As the description cannot be resolved, a mechanism of *accommodation* adequately extends the discourse context with a marker that can play the role of the antecedent (see Beaver 1997: 976, 989-990). This mechanism therefore induces context-shifts in order to allow updates of DRSs so that the discourse process can go on. If a marker is introduced by accommodation, it can nevertheless be later cancelled by some revision, such as in the following dialogue:

(19) *Dialogue*
    A. "Santa Claus is coming."
    B. "No, he doesn't exist!"

Those pragmatic mechanisms of accommodation and cancellation appear to be unavoidable to account for the semantics of discourses. As Peregrin puts it: "For the semantics to become really dynamic, we must turn denotations not only into 'context-consumers,' but also into 'context-producers' – so that an utterance might consume a context produced by a preceding one." (Peregrin 2000). According to Groenendijk and Stokhof, this is even one of the main characteristics of the dynamic turn: "What *is* new, is the focus on context *change*: interpretation not only *depends* on the context, but also *creates* context" (Groenendijk and Stokhof 1999: 6).

DRT introduces those mechanisms in a natural way, for it does not pretend to deal directly with models but only with *representations*. In comparison, GTS, interpreted in a representational or realistic way, is seriously handicapped since its domain is static: the ideal players cannot stipulate the existence of new individuals beyond that of previously established ones.

The resort to DRT can be misleading and suggest that, as this theory stipulates an intermediate representative level between language and models, dynamic semantics requires a conceptualist or mentalist construal of semantical interpretation. Semantics and logic would then collapse into

---

[26] The accessibility relations between universes of distinct DRSs are strictly specified: within a DRS, only the universes of the antecedent and of the contextual DRSs are available; those of consequent and sub-DRSs are irrelevant.

psychology. Fortunately, there is nothing of the sort. DRT discourse referents are not to be thought of as 'mental entities': they are neither more nor less than the functional role they play in the theory, namely the role of antecedents in anaphoric processes; since anaphoric processes are fundamentally inferential processes, discourse referents are determined by their *inferential role*.

Can such considerations be transposed to model-theoretic objects such as those involved in GTS? It might be objected that if one goes back to the evaluation of DRSs, standard representational semantics will take over, so that e.g. the discourse referent connected with 'Cinderella' have no semantic value. Nevertheless, the examples checked in this section indicate that two important features of DRT – the decoupling between the procedural and representational components of meaning, and the determination of the 'referents' by their functional role in the evaluation theory – might be not specific to this very framework but that they could be characteristic of dynamic (procedural) semantics in general.[27]

4.3. *Dynamic vs. Static Models*

The independence of procedural semantics from representational theories is in fact acknowledged by a recent GTS account of anaphora based on games in extensive form (see Janasik and Sandu, forthcoming). Although defined on some underlying models, these games essentially emphasize the procedural aspects of the meaning of discourse: they highlight the information flow through the evaluation process with no reference to the truth-conditions. This strategy enables GTS to deal with the problematic issues raised above in a natural way. As Janasik and Sandu state: "the idea … is to divorce matters of truth from matters of anaphora, which, in turn, is an aspect of the separation of truth and meaning" (*op.cit.*: 24). While playing the game associated with e.g. 'A man enters', relatively to a model $\mathbf{M}$ and a (partial) assignment g, the verifier will produce a modification of the assignment $g[x/a]$ with no resort to a choice set: "… the information required for resolving anaphoric links can be extracted from the histories of the game given in extensive form. … Whether a fragment of discourse comes out true or false is settled only after the whole discourse is game-theoretically processed" (*Ibid.*). This new formation of GTS appears to converge very strongly with DRT. In particular, it enables GTS to resolve anaphoric links with empty heads, such as 'Superman came. He killed all the murderers', that could not be processed by the standard version.

The salience of the *information flow* through the evaluation process hence appears to be a ubiquitous feature of dynamic (procedural) semantics. As is underlined by Gochet: "As discourse develops, both information about the *situation* and information about the *text* are updated" (Gochet 2002: 180). This is indeed an important reason why IF logic should be considered our natural logic, with its two-component meaning of quantifiers. However, all this doesn't entail by itself the accuracy of the idea advocated in this paper, i.e. that we should conceive of this procedural dimension as independent from a standard representational one.

Let us now consider the following proposal: the priorities between models and information flow should be reversed. This would ultimately solve the abovementioned problems of dialogues with speakers sharing different beliefs, but however understanding each other (such as e.g. the parents and their child speaking about Santa Claus). How could this be realized within the GTS framework?

A liberalization of GTS from its (static) ontological or representational straitjacket is in fact indirectly suggested by the semantic interpretation of DRSs. Discourse representations can indeed yield a model-theoretic interpretation through an *anchor-function*: such a function associates each reference marker of the universe of the main DRS with an individual in a domain such that all the properties and relations expressed in the set of conditions be preserved among the corresponding

---

[27] This seems to be Peregrin's viewpoint, when he argues for a general reduction of "reference" to "inference" *via* "co-reference": "If we recognize individuaries [sets of individuals contextually introduced by dynamic semantics] and their inhabitants as mere tools to account for inferences, then the talk about reference becomes essentially parasitic upon the talk of inference – a *referent* is nothing more than an illustrious clamp holding certain inferentially related expressions together." (Peregrin 2000)

semantic values. If a anchor-function can be constructed relatively to a fixed model *M*, then the discourse is true in *M*, and the DRS is said to be *compatible* with *M*: it partially models the model (see Eijck and Kamp 1997: 195sq).[28] The perspective can hence be reversed in a very natural manner: as a DRS can be evaluated relatively to an already determined model, one can *build models* on the grounds of discourse representations. The only requirement is that the main DRS be coherent, i.e. its set of conditions without any contradiction: an anchor-function can then be constructed, which *stipulates* objects corresponding to reference markers. DRT thus leads us to a really neutral viewpoint on models and truth,[29] better: a genuine dynamic, i.e. constructivist conception of semantic interpretation.

Therefore, to get a fully dynamic (and successful) model-theoretic account of semantics, one needs to remove static realistic models. This was suggested above by the possibility of an extension of the interpretation function *F* so that the ideal players of GTS can *create* a denotation for fictional proper names such as 'Cinderella'. Creating new objects means changing the domain by bringing in some new individuals. This is one more step, and perhaps the ultimate one, towards a complete 'dynamification' of natural language semantics, which is explicitly drawn by van Benthem about "the dynamic potential of Tarski's truth definition":

Not just *variable assignments s*, but also its other parameters admit of dynamization. The literature has many scattered examples of this. Shifting *interpretation functions I* are involved in ambiguous discourse, or in answering questions, where we learn about denotations of predicates. … Next, *shifting individual domains D* make sense, too. For instance, there are dynamic readings of an existential quantifier which go beyond DPL in that they introduce a *new object* satisfying some description. (van Benthem, 1996: 39)[30]

Allowing domain shifts means that the relations between a language and its models are reversed, at least partially: the language is no more interpreted in some already given structure, but the structure will change through the evaluation process. This leads to an anti-realistic conception of

---

[28] Semantic interpretations of DRSs allow a refinement of our notion of a discourse referent. In his presentation of a (dynamic-minded) system of "epistemic predicate logic" (EPL), Dekker (1996) proposes an interpretation of DRSs in terms of possible worlds – the content or meaning of representations, that is "the set of possible worlds which might be the actual one for as far as you know" – where reference markers are associated with a set of individuals: "A partially known individual, a subject, is characterized by the set of individuals each one of which has all the properties you ascribe to him" (Dekker 1996: 5). Such 'subjects' (regimented by the reference markers) can thus hardly be taken to be "discrete individuals", they are only "partial objects" (*ibid.*). So, according to this rather intuitive semantic interpretation of DRT, discourse referents cannot be conceived as standing for genuine or *substantial* 'mental entities'. It must however be noticed that Dekker would not agree with Peregrin's conception of markers:

> We believe that subjects have more substance than that of mere devices to facilitate the interpretation of (anaphoric) structures in discourse. … The key to understanding subjects, we believe, is that they are addressable, and even re-addressable, from different perspectives. … Subjects should thus be thought of as representing 'live' sources of information. (*op.cit.*: 14-15).

Nonetheless, such an additional epistemic feature doesn't seem to imply any reification of the items occurring within DRSs.

[29] This is clearly underlined by Davia: "Since truth is modelled in DRT as an intralinguistic quality, an epistemologically minimal explicatum is achieved, that distinguishes itself by epistemological neutrality and invariance. Any epistemological commitment (as to Realism, Idealism or whatsoever) seems compatible with it, and it may serve to demonstrate and clarify the neuralgic points of any truth theory, the normative or justificatory component. … The chosen formal framework is not a very simple device of explication [of truth], but in return an ontologically minimal explicatum is attained, that distinguishes itself by ontological neutrality and invariance. Any ontological commitment (as to Platonism, Nominalism or whatsoever) seems compatible with it, because the concept of 'real world' [represented by the model] is used as a merely structural, undefined term." (Davia 1994: 68-69)

[30] A positive account of a 'dynamic semantics' *stricto sensu* – i.e., in the sense that the dynamics is carried by the meanings of expressions and not by some *representations* of the meanings such as DRSs – is provided by Groenendijk and Stokhof by means of possible worlds. Genuine 'context sets' (i.e., made of individuals and not of representatives) are built through discourse processing, which enable contextually restricted quantification (so that anaphoric relationships are accounted for) and are compatible with accommodation (see Groenendijk and Stokhof 1999).

(the domains of) models, even though the evaluation of the truth-value of a sentence or discourse still remains relative to some given model.

Eventually, it seems obvious that one has to choose one's task as a semanticist: one can either try to give an account of (genuine) ontology, and deal with many puzzling issues, or try to give an account of linguistic meaning in its dynamic features, but not both.[31]

5. CONCLUDING REMARKS

What is, finally, the status of individual semantic values, i.e. of the model-theoretic 'objects'? Let us quickly recapitulate.

According to the universalistic criterion inherited from Quine, they are *bona fide* ontologically relevant objects. But such a realistic conception conflicts in many ways with semantical theories as they account for more and more procedural features that do not directly rely on *what there is*. This appears to be particularly striking in natural language anaphoric relations, whose suitable theoretical accounts require emancipation from ontological constraints. Similar important tensions also arise within the game-theoretic framework as it involves the dynamics of information flow.

The dynamic turn in semantics hence does not only support procedural semantics: it implicitly suggests departing from the standard conception of procedural theories as relying on representational semantics. The core area of semantics should move from models to information flow, and the models be subordinate to the evaluation process.

'Objects' would thus be basically determined by their functional role in procedural theories. In the GTS frame, objects are to be conceived of as the items required for semantic games: they can be created or canceled by the ideal players, or both. Quine's criterion of ontological commitment must therefore be revised: *to be the value of a variable* is no more *to be*, but *to be available in some evaluation process* (game-theoretical or not). It is no more a criterion of ontological commitment, but it renders the real meaning of quantified variables in dynamic semantics.

In a procedural account of GTS, games, players, and their knowledge and abilities are to be considered in a serious manner. It leads us to depart from the conception of evaluation games as redundant in some way, the existence of choice functions being more fundamental. This is of course crucial in order to deal with the possible variations of the information flow within semantics and to produce all what can be in the game-theoretic frame.

Finally, we are led to a conception of semantic items as immanently carried out by the language process. Rather than looking for any foundational representational semantics, one should observe language from inside, and grasp the generation process of semantical objects as genuine linguistic, i.e. *ontologically neutral*, items.

REFERENCES

Beaver, David Ian: 1997, 'Presupposition', in J. van Benthem and A. ter Meulen (eds), *Handbook of Logic and Language*, Elsevier, Amsterdam, 939-1008.

Van Benthem, Johan: 1996, *Exploring Logical Dynamics*, CSLI Publications, Stanford.

Van Benthem, Johan: forthcoming, ''Hintikka Self-Applied': An Essay on the Epistemic Logic of Imperfect Information Games', in Hahn Lewis (ed), Hintikka Volume, *Library of Living Philosophers*.

---

[31] As Stokhof puts it: "[The] transition from truth conditional content to context change potential as the core notion of semantics … emphasizes that … interaction between language users and not an independent word–to–world relation is what meaning is primarily concerned with." (Stokhof, forthcoming: 18).

Carnap, Rudolf: 1950, 'Empiricism, Semantics and Ontology', *Revue Internationale de Philosophie* **4**, 20-40.

Davia, Gregg Alan: 1994, 'Truth in Discourse Representation Theory', *in* G.Meggle (ed), 1997: *Analyomen 2. Proceedings of the 2nd Conference 'Perspectives in Analytical Philosophy'. Vol.II. Philosophy of Language, Metaphysics*, Walter de Gruyter, Berlin, 61-69.

Dekker, Paul: 1996, *Reference and Representation*, Research Report, ILLC, University of Amsterdam.

Donnellan, Keith S.: 1966, 'Reference and Definite Description', *The Philosophical Review* **77**, 281-304.

Eijck, Jan van and Hans Kamp: 1997, 'Representing Discourse in Context', in J. van Benthem and A. ter Meulen (eds), *Handbook of Logic and Language*, Elsevier, Amsterdam, 179-237.

Evans, Gareth: 1982, *The Varieties of Reference*, Oxford University Press, New York.

Gochet, Paul: 2002, 'The Dynamic Turn in Twentieth Century Logic', *Synthese* **130**, 175-184.

Groenendijk, Jeroen and Martin Stokhf: 1999, 'Meaning in Motion', in K. von Heusinger and U. Egli (eds), *Reference and Anaphoric Relations*, Kluwer, Dordrecht, 47-76.

Hand, Michael: 1993, 'A Defense of Branching Quantification', *Synthese* **95**, 419-432.

Hintikka, Jaakko: 1984, 'Are There Nonexistent Objects? Why Not? But Where Are They?', *Synthese* **60**, 451-458.

Hintikka, Jaakko: 1985, 'Is Truth Ineffable ?', *in* [Coll.] 1989: *Les Formes actuelles du vrai* (Entretiens de Palerme 1985), Enchiidion, Palerme, 89-120.

Hintikka, Jaakko: 1987, 'Game Theoretical Semantics as a Synthesis of Verificationist and Truth-Conditional Meaning Theories', in E. le Pore (ed), *New Directions in Semantics*, Academic Press, 235-258.

Hintikka, Jaakko: 1988, 'On the Development of the model-theoretic viewpoint in logical theory', *Synthese* **77**, 1-36.

Hintikka, Jaakko: 1990, 'Paradigms for Language Theory', *Acta Philosophica Fennica* 1990, 181-209.

Hintikka, Jaakko: 1996, *Principles of Mathematics Revisited*, Cambridge University Press.

Hintikka, Jaakko: 1998, 'Truth Definitions, Skolem Functions and Axiomatic Set Theory', *The Bulletin of Symbolic Logic* **4**, 303-337.

Hintikka, Jaakko: 2001, 'Post-Tarskian Truth', *Synthese* **126**, 17-36.

Hintikka, Jaakko: 2002, 'Hyperclassical Logic (A.K.A. IF Logic) and its Implications for Logical Theory', *The Bulletin of Symbolic Logic* **8**, 404-423.

Hintikka, Jaakko and Gabriel Sandu: 1994, 'What is a Quantifier?', *Synthese* **98**, 113-129.

Hintikka, Jaakko and Gabriel Sandu: 1997, 'Game-Theoretical Semantics', in J. van Benthem and A. ter Meulen (eds), *Handbook of Logic and Language*, Elsevier, Amsterdam, 361-410.

Janasik, Tapio and Gabriel Sandu: forthcoming, 'Dynamic Game Semantics', in J. Peregrin (ed.): *Meaning: The Dynamic Turn*, Elsevier.

Kripke, Saul A.: 1977, 'Speaker's Reference and Semantic Reference' in P.A. French, T.E. Uehling Jr., and H.K. Wettstein (eds), *Studies in the Philosophy of Language*, Midwest Studies in Philosophy, no. 2, University of Minnesota Press, Mineapolis.

Landry, Elaine: 2001, 'Logicism, Structuralism and Objectivity', *Topoi* **20**, 79-95.

Martino, Enrico: 2001, 'Arbitrary Reference in Mathematical Reasoning', *Topoi* **20**, 65-77.

Niiniluoto, Ilkka: 1997, 'Theories of Truth: Vienna, Berlin, and Warsaw', in J. Wolenski and E. Köhler (eds), 1999: *Alfred Tarski and the Vienna Circle. Austro-Polish Connections in Logical Empiricism*, Kluwer Academic Publishers, Dordrecht, 17-26.

Peregrin, Jaroslav: 1999, 'Formal Logic and the Pursuit of Meaning'. (Unpublished manuscript).

Peregrin, Jaroslav: 2000, 'Reference and Inference: The Case of Anaphora', in K. von Heusinger and U. Egli (eds), *Reference and Anaphoric Relations*, Kluwer, Dordrecht, 269-286.

Puntel, Lorenz B.: 2001, 'Truth, Sentential Non-Compositionality, and Ontology', *Synthese* **126**, 221-259.

Putnam, Hilary: 1975, 'The Meaning of 'Meaning'', in K. Gunderson (ed), *Language, Mind & Knowledge*, Minneapolis, 131–93.

Quine, Willard Van Orman: 1960, *Word and Object*, MIT Press.

Quine, Willard Van Orman: 1969, *Ontological Relativity and Other Essays*, Columbia University Press, New York.

Quine, Willard Van Orman: 1970, *Philosophy of Logic*, Prentice Hall, Englewood Cliffs (N.J.).

Recanati, François: 1996, 'Domains of Discourse', *Linguistics and Philosophy* **19**, 445-475.

Recanati, François: 2000, *Oratio Obliqua, Oratio Recta. An Essay on Metarepresentation*, MIT Press, Cambridge, Mass.

Rivenc, François: 1998, 'Quantifier n'est pas jouer. Absolutisme et relativisme dans la *GTS*', in E. Rigal (ed), *Jaakko Hintikka. Questions de logique et de phénoménologie*, Vrin, Paris, 149-169.

Sandu, Gabriel: 1997, 'On the Theory of Anaphora: Dynamic Predicate Logic vs. Game-Theoretical Semantics', *Linguistics and Philosophy* 20, 147-174.

Sluga, Hans: 1997, 'Truth before Tarski', in J. Wolenski and E. Köhler (eds), 1999, *Alfred Tarski and the Vienna Circle. Austro-Polish Connections in Logical Empiricism*, Kluwer Academic Publishers, Dordrecht, 27-41.

Stokhof, Martin: forthcoming, 'Meaning, Interpretation and Semantics', in D. Beaver and P. Scotto di Luzio (eds), *Logic, Language and Diagrams*, CSLI Press, Stanford.

Wettstein, Howard K.: 1984, 'Did the Greeks Really Worship Zeus?', *Synthese* 60, 439-449.

Zalta, Edward N.: 1984, 'Referring to Fictional Characters'. (Unpublished manuscript).