# Jigsaw Semantics

Paul J E. Dekker

*ILLC/Department of Philosophy*

PAUL J. E. DEKKER
ILLC/Department of Philosophy
Universiteit van Amsterdam
The Netherlands

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ABSTRACT: In the last decade the enterprise of formal semantics has been under attack from several philosophical and linguistic perspectives, and it has certainly suffered from its own scattered state, which hosts quite a variety of paradigms which may seem to be incompatible. It will not do to try and answer the arguments of the critics, because the arguments are often well-taken. The negative conclusions, however, I believe are not. The only adequate reply seems to be a constructive one, which puts several pieces of formal semantics, in particular dynamic semantics, together again.

In this paper I will try and sketch an overview of tasks, techniques, and results, which serves to at least suggest that it is possible to develop a coherent overall picture of undeniably important and structural phenomena in the interpretation of natural language. The idea is that the concept of meanings as truth conditions after all provides an excellent start for an integrated study of the meaning and use of natural language, and that an extended notion of goal directed pragmatics naturally complements this picture. None of the results reported here are really new, but we think it is important to re-collect them.

## 1. INTRODUCTION

Anybody involved in the formal study of the interpretation of natural language will notice that the discipline, to the extent that it is fair to speak of one at all, is utterly scattered. If one enters the field with a pure academic or intellectual interest, the diversity of grammars and interpretation systems is bewildering. One finds varieties of lexical, computational, cognitive, and representational semantics, structured meanings, update semantics, constructive or proof-theoretic systems of semantics, constraints-based and optimality theoretic semantics. It is an open question whether any two of the paradigms alluded to comply with each other, complement each other, or are perhaps (methodologically) inconsistent with one another.

The bright-minded scholars will also hear voices that claim that the enterprise is doomed to failure—from the very beginning. Such voices are interesting because they are often from those who have first been involved in the enterprise, and doomed it to failure later, so they have to be taken seriously. For example, Emma Borg has observed: "These days, the natural descendent of the formal approach, known as minimalism, has been consigned to the margins: not everyone rejects minimalism, but lots of people do. Minimalism is rejected in favor of contextualism: roughly, the idea that pragmatic effects are endemic throughout truth-evaluable semantic content." (Borg 2007, p. 339). In a similar vein, Jason Stanley comments on the idea that intuitive interpretations of sentences are not generated by compositional semantic interpretation: "A large number of researchers opposed to the semanticist employ arguments of this sort (a brief list of the most prominent exponents includes Kent Bach, Herman Cappelen, Robyn Carston, Ernie Lepore, Stephen Levinson, François Recanati, Dan Sperber, Charles Travis, and Deirdre Wilson; there are many more)." (Stanley 2005, p. 223) Although one may question whether all of the mentioned authors would agree with the attitude Stanley ascribes to them (in particular Cappelen and Lepore), the attitude is widespread among philosophers of language, as Borg observes. She herself mentions: "Travis, Searle, Recanati, and the relevance theorists (Sperber and Wilson, Carston, and many others) as the seminal figures here." (p. 340)

With this paper I want to recite reasons for engaging in the en-

terprise of formal semantics (by which I mean truth-conditional semantics, in the tradition initiated by Richard Montague), and formal pragmatics (by which I mean goal-directed pragmatics in the tradition initiated by Grice). If the enterprise is not overestimated, for instance by aiming to gain insight into the nature of our innate cognitive structures, I believe it is sound and revealing. I also believe it is sound and revealing to a much greater extent than the work of critics who do not seem to have formal or theoretical alternatives on offer—because their message basically is that natural language resists generalizations and formalizations of the kind developed in the area of formal semantics.

In this paper I will focus on language as a 'vehicle' for the exchange of information. I will be concerned only with the descriptive aspects of languages, and the devices to achieve the descriptive goals and uses of language users. It must be clear that I acknowledge other types of language use, but taking all types and aspects of language into account would require a whole book, or, rather, a whole bookshelf. The aim is to develop a coherent picture of interpretation which integrates truth-conditional semantics with goal-directed pragmatics. There is certainly no implication that the views advocated here are the only way to go. The main conclusion is that it is one coherent way to go, without excluding other ways to go. But it is a way to go towards generalizations about natural language interpretation.

An interesting question, which will not really be addressed here, is raised by Barbara H. Partee 1979, whether semantics is a branch of mathematics, or a branch of psychology. The point of view elaborated in this paper can be appreciated best if one does not assume semantics is either one of them. I also think that it is not physics, or any of the other natural sciences. My hope is that semantics can survive as a formal study which resembles the modeling carried out in economics or sociology, but in a philosophical spirit.

In the following sections I will first provide (external) motivation for a truth-conditional semantics of a local and a global variety. The local variety is mainly concerned with the determination of the truth conditions of sentences, in context, and the global one with the, equally contextual, establishment of discourse relations. I will next provide (external) motivation for a goal-directed pragmatics, also of a local and a global variety. The local variety focuses on individual utterances,

again in context, of course. The global variety conceives of them in the wider context consisting of the goals, beliefs and intentions of the interlocutors. Finally, I want to give my views on arguments which have been raised in the so-called 'contextualist debate'.

## 2.   ON TRUTH-CONDITIONAL SEMANTICS

### 2.1.   The Local Variety of TCS

Most probably the interested reader is familiar enough with the reasons for engaging in truth-conditional semantics, but even so I would like to repeat arguments for it from the most motivating and inspiring sources. Gottlob Frege, who I believe to be the first, developed the idea that the reference of a sentence is its truth value. The *Meaning* ("Sinn") is a *mode of presentation* ("Art des Gegebenseins") of the *reference* ("Bedeutung"). In the case of a sentence this concerns a *thought* ("Gedanke") and a *truth value* ("Wahrheitswert"), respectively. He noted: "Warum genügt uns der Gedanke nicht? Weil und soweit es uns auf seinen Wahrheitswert ankommt." ("Why is the thought not enough? Because and insofar as we are concerned with its truth.") (Frege 1892, p. 33) "Ein Urteil ist mir nicht das bloße Fassen eines Gedankens, sondern die Anerkennung seiner Wahrheit." ("A judgment is not just the grasping of a thought, but the acknowledgment of its truth.") (Frege 1892, fn. 7) "So werden wir dahin gedrängt, den Wahrheitswert eines Satzes als seine Bedeutung anzuerkennen." ("So we are forced to acknowledge the truth value of a sentence as its reference.") (Frege 1892, p. 34) It is not just the thought, the meaning of a sentence, or its representation of truth or falsehood, that counts, but the establishment of its truth or truth-value.

Ludwig Wittgenstein has put this very succinctly. "Einen Satz verstehen, heißt, wissen was der Fall ist, wenn er wahr ist." ("To understand a sentence means knowing what is the case in case it is true.") (Wittgenstein 1922, 4.024) If we push Frege and Wittgenstein to the limit, if knowledge of meanings implies knowledge of truth conditions, then meanings *include* truth conditions.

In different contexts, and for different purposes, Alfred Tarski and Willard Van Orman Quine have focused on the notions of truth. (And, more generally, on *satisfaction*. In this paper, however, we focus

on truth.) "It is for these reasons that we count the concept of truth which is discussed here among the concepts of semantics, and the problem of defining truth proves to be closely related to the more general problem of setting up the foundations of theoretical semantics." (Tarski 1944, §5)

"(. . . ) we wish to use the term "*true*" in such a way that all equivalences of the form (T) [*X* is true if, and only if, *p*] can be asserted, and we shall call a definition of truth "adequate" [from the material point of view] *if all these equivalences follow from it.*" (Tarski 1944, §4) Quine also modestly reported: "In this chapter we shall consider how much of language can be made sense of in terms of its stimulus conditions, and what scope this leaves for empirically unconditioned variation in one's conceptual scheme." (Quine 1960, p. 26) "There is nothing in linguistic meaning, then, beyond what is to be taken from overt behavior in observable circumstances." (Quine 1987, p. 5) Quine, at the time the advocate of a behaviorist analysis of meaning, obviously did not aim at a formal semantic approach to meaning like the one defended here. However, he can be taken to share, with Tarski and others, a focus on the external circumstances as guiding the description and explanation of meaningful linguistic behavior. Also pushing Tarski, and perhaps Quine, to the limit, then: meaning, if anything, is nothing but truth- (or satisfaction-) conditions.

Neither Frege, nor Wittgenstein, nor Tarski, nor Quine, were engaged in the enterprise of formalizing the interpretation of natural language. But after the original and seminal work of Chomsky, in the 1950's, researchers started to develop a formal program for the interpretation of natural language, with very optimistic ideals. "(. . . ) I regard the construction of a theory of truth—or rather, of the more general notion of truth under an arbitrary interpretation—as the basic goal of serious syntax and semantics." (Montague 1974, p. 188) "Semantics with no treatment of truth conditions is not semantics." (Lewis 1970, p. 18) "(. . . ) an essential part of semantics is the construction of a theory of truth for a language." (Partee 1973, p. 509) "Two aspects of Montague's approach looked especially exciting. The first was the revolutionary (to a linguist) idea that the core data were the truth conditions of sentences." (Partee 2004, p. 5)

It seems to me that all of these quotes are well-taken. They

may have to be adapted for current and more specific programs of research, but the programs and purposes cannot be denied to have been fruitful in uncovering linguistic data. What is valuable about all of the advocated approaches is that they are neatly formalized, and, therefore, in principle, testable.

### 2.2. The Global Variety of TCS

The paradigm of truth-conditional semantics has been challenged, for good reasons, but, as I would like to argue, in a non-conclusive way. The inspiration may, again, come from a non-suspect source. The early Ludwig Wittgenstein already wrote: "Wir machen uns Bilder der Tatsachen." ("We make ourselves pictures of facts.") (Wittgenstein 1922, 2.1) "Das Bild ist ein Modell der Wirklichkeit." ("The picture is a model of reality.") (Wittgenstein 1922, 2.12) These statements appear to be obvious, but notice that we make ourselves substantial interconnected representations of reality, of all kinds, pictorial, schematic, musical notation, chord schemes, and linguistic ones. But the question must then be asked: how do we communicate them? We communicate them in bits and pieces. Here lies a problem of decomposition and reconstruction. We have got highly structured representations, and we decompose them, and communicate the pieces, and the audience has the task of reconstructing the pieces into, hopefully, the original complete picture again.

The disciplines of *Discourse Representation Theory* (*DRT*) and *Dynamic Predicate Logic* (*DPL*) have established ways to model this type of decomposition and reconstruction. The two frameworks are mainly focused on the interpretation of anaphoric relationships, but these may very well serve to metaphorically model any type of decomposition and reconstruction activities.

Discourse Representation Theory (*DRT*) can be explained most easily because of its representational nature. (Therefore it may also count as less informative.) Consider the following example.

- A man who was walking ran away from a dog he saw.

One might render the meaning of this sentence by means of the following first order predicate logical formula (with obvious abbreviations; for the sake of perspicuity, temporal and aspectual aspects are

neglected).

- $\exists x((Mx \wedge Wx) \wedge \exists y((Dy \wedge Sxy) \wedge Rxy))$.

In the language of *DRT* the contents are pictorially rendered as follows.

In a *DRS*:

| $x$ | $y$ | |
|-----|-----|-----|
| $Mx$ | $Dy$ | |
| $Wx$ | $Sxy$ | $Rxy$ |

Even though we can communicate these contents in one sentence (like we did above), we may try and decompose it into bits and pieces, and the way in which we do this may be significant for our treatment of the exchange of information which cannot realistically be communicated in one sentence. In *DRT* things may go as follows. We may cut up the story into three sentences.

(1) A man was walking in the park.

(2) He saw a dog.

(3) He ran away from it.

The three sentences are each associated with their own discourse representation.

| $x_1$ | $y_2$ | |
|-------|-------|-----|
| $Mx_1$ | $Dy_2$ | |
| $Wx_1$ | $Sx_2y_2$ | $Rx_3y_3$ |

If we are given these bits and pieces, what we have to do is a form of discourse-representational-theoretic reconstruction, for instance, to the effect that $x_1 = x_2 = x_3$ and $y_2 = y_3$. If we do so, we have indeed reconstructed the original interpretation. The example may seem to be a bit artificial, but the procedure of decomposition and reconstruction works for any kind of connection in discourse or representation, whether it has to do with identity, anaphora, or causal, temporal or discourse relations.

There is, however, an old reason not to be totally satisfied with this picture. David Lewis has, not against *DRT* in particular, but against any representational system of interpretation, argued that "Translation

into Markerese is at best a substitute for real semantics." (Lewis 1970, p. 18) Jeroen Groenendijk and Martin Stokhof, arguing in particular against *DRT*, claimed that "Our own opinion, for whatever it is worth, is that the calculating mind is a metaphor rather than a model. It is a powerful metaphor, no doubt, on which many branches of 'cognitive' science are based, and sometimes it can be helpful, even insightful. But it remains a way of speaking, rather than a true description of the way we are." (Groenendijk & Stokhof 1991, p. 97) Moreover, we have to wonder how we communicate the information displayed by pictures, paintings, schemes, pieces of music, or even feelings. We most likely have our conceptual or cognitive representations of them—our own private pictures, impressions, recollections or imaginations—, but it is equally likely that these are not discourse representation structures, or representations of any linguistic kind. Nevertheless we may, at least to some extent, convey this type of information adequately, that is, if by means of a medium which mimics the required kind of satisfaction, or realization, conditions.

Consider, for instance the kind of information that one may gain from the following map of the Budapest metro system.
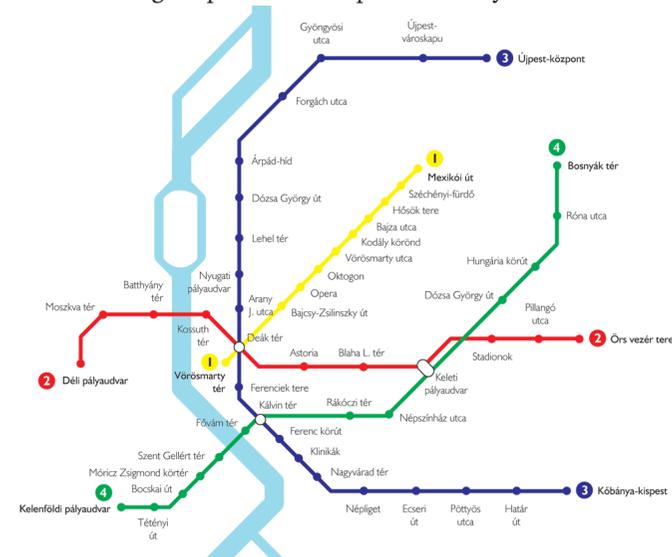


The map indicates metro stations standing in direct and indirect con-

nections, and standing in spatial relations with one another. The map itself, however, is not a formula or a discourse representation structure, and our conceptual representation of it need not be either. Even so, what the map displays can only be adequately captured by means of the right truth conditions. What else? For instance, we would like to interpret it as entailing that there is a station, Deák Tér, at the intersection of three lines. If $i \models$ `BudapestMetro.png` then $i \models \exists x(STATx \land \exists 3y(LINEy \land ONxy))$.

Jeroen Groenendijk and Martin Stokhof have developed a semantic, and arguably non-representational, system of interpretation that may deal with the type of decomposition and reconstruction we have seen above. Their system of *Dynamic Predicate Logic* (*DPL*) succeeds in associating the three individual sentences in the above example with independent meanings, in terms of input- output-conditions. Very briefly, the (formally most intriguing) middle sentence requires as an input an assignment which associates $x$ with someone who sees a dog, and renders as output an assignment with the same value for $x$, and which associates $y$ with a dog $x$ sees. Formally:

- $\langle g, h \rangle \in [[\exists y(Dy \land Sxy)]]$ iff $g[y]h$ and $h(y)$ is a dog such that $g(x)$ sees $h(y)$.

The results are satisfying and formally transparent.

While it has been argued that the sort of natural language phenomena at issue require a representational semantics, like that of *DRT*, Groenendijk and Stokhof have argued that they can do with a dynamic semantic treatment, and only change our concept of static meanings into a dynamic one. However, it has been shown that we can also do with a static, truth-conditional concept of meaning, if only we allow some dynamic flexibility in the conjunction, or, more general, composition, of meanings.

The system of *Predicate Logic with Anaphora* (*PLA*) is a semantic system that covers *DRT* and *DPL* results in a compositional fashion, and it is just a Tarskian satisfaction system for a logical language with pronouns. Dekker (2002, 2004) The system employs satisfying witnesses for singular and plural terms referred to in discourse, and the dynamics of interpretation is entirely covered by a dynamic notion of conjunction, which basically fleshes out the idea that a conjunction has a first, and a last conjunct. The simple idea is that, before a conjunc-

tion, the first conjunct will be coming first, and after the conjunction, the second one has come last.

The system of *PLA* is itself not formulated as a dynamic, or update semantics, but as a Tarski-style satisfaction semantics, with witnesses, and dynamic conjunction. Anaphoric discourse connections are established by means of pronouns ($\text{p}_1, \text{p}_2, \dots$) which relate to discourse items introduced before in the discourse. For example, a sequence $de\dots \models (\exists x(Mx \land Wx); \exists y(Dy \land S\text{p}_1y))$ iff $e\dots \models \exists x(Mx \land Wx)$ and $de\dots \models \exists y(Dy \land S\text{p}_1y)$ iff $e$ is a man who walks in the park, and $d$ is a dog which $e$ sees.

The system is satisfying as well, because it comes with no grand claims about meaning, besides being a Tarskian satisfaction semantics, and it covers the basic results of *DRT* and *DPL*. Without going into the details of the system here, the moral seems to be that all the work in truth-conditional semantics is still exciting and valuable and promising, as is the work done in dynamic semantics. A side moral is that dynamic semantics is not (just) about anaphoric relationships, but it is a program for understanding the structured exchange of complex information in discourse. And the main conclusion is that a dynamic semantics can be modeled after the format of a classical Tarskian satisfaction semantics.

### 3. ON GOAL-DIRECTED PRAGMATICS

Most of the work mentioned above has focused on formulas or sentences, not utterances, which are all of an indicative nature. It is clear that there are other than indicative sentences, and other uses of sentences than assertions only. We will not, and cannot, go into the whole array of linguistic functions, but we do want to inspect in a little more detail what has been achieved in the formalization of inquisitive discourse, discourse that consists of informative and interrogative utterances. As in the previous section, we will first comment on a so-called 'local' variety of research, and next tune in on a 'global' approach.

#### 3.1. *The Local Variety of GDP*

Building on Stalnaker's notion of a common ground, or a context set, and on its updates, Jonathan Ginzburg, Craige Roberts, Nicholas Asher

and Alex Lascarides, among many many others, have proposed models/analyses of how to deal with, at least, inquisitive discourses, structured discourses consisting of questions and assertions. Ginzburg (1995, To appear); Roberts (1996, 2004); Asher & Lascarides (1998); Lascarides & Asher (2009) As Roberts has put it: "Following Stalnaker (1979), I assume that the primary goal of discourse is communal inquiry—the attempt to discover and share with the other interlocutors "the way things are", i.e. to share information about our world. But we must develop strategies for achieving this goal, and these strategies involve sub-inquiries. As in a game, some strategies may be better, some worse (. . . ); this is largely a matter of the rationality of the participants, and not of linguistic competence per se. Whether strategies are effective involves, as well, an element of luck, as in any inquiry. To understand better what I have in mind, let us pursue the analogy with games." (Roberts 1996, p. 92)

There may be an obvious common theme in the work of the authors cited, but there happens to be a wide variety of systems of goal-directed pragmatics. We find *Context Sets*, *Segmented DRT*, *Dialogue Game-Boards*, *Moves*, *Intentional States*, *Stacks of Questions under Discussion*, *Acceptance*, *Rejection*, *Resolving and Popping Questions*, *Strategies of Inquiry*, and what have you. (All of them with good reason, by the way.) Indeed, this looks like a bewildering variety of representational, dynamic, situation- or type-, or game-theoretic grammars for discourse, seemingly at odds with one another, or at least mutually untranslatable. However, from a wider point of view, they are similar in spirit, and it seems a truth-conditional, or satisfaction-based, approach still can be taken to be a motivating and unifying common thread. There is, at worst, indeterminacy of mutual translation. Again a formalized and interpretation oriented perspective seems to be most fertile. One such system is that of inquisitive semantics, originating from Groenendijk (1999), and much further elaborated in Groenendijk & Roelofsen (2009).

Inquisitive semantics has grown out of the logic of interrogation, which was inspired by Gerhard Jäger's integrated dynamic semantic satisfaction of questions and assertions Jäger (1996) and Joris Hulstijn's program of "Raising and Resolving Issues in Discourse" Hulstijn (1997). The core idea is that there is a common ground $\sigma$ which con-

tains data and issues. Intuitively, the data that are publicly known, or better, publicly presented in a discourse; the issues are for the most part those that have been raised, and not yet answered, in a discourse. These are quite nicely formalized in terms of relations over sets of possibilities, be it worlds, or situations, or satisfaction points. These relations are assumed to be transitive and symmetric. The idea is that all points figuring in the relation are considered possible, where those not figuring in the relation are considered to beexcluded. In this way the relation captures a notion of what the world is conceived to be like, viz., a world like one of those figuring in the relation and not one of those excluded. For possibilities which are related, the idea is that the difference between them is immaterial, so not an issue. For possibilities $i$ and $j$ in the relation which are not connected, the idea is that it is an issue whether the world is like $i$ or like $j$.

If we have such a (transitive and symmetric) relation $\sigma$ on points, we can define the data $D(\sigma)$ in a more traditional style as follows.

- $D(\sigma) = \{i \mid \langle i, i \rangle \in \sigma\}$.

This gives us the set of worlds conceived possible. And we can define the issue $I(\sigma)$ as the set of pairs of worlds which are conceived possible and the difference between which matters.

- $I(\sigma) = \{\langle i, j \rangle \mid i, j \in D(\sigma), \text{ and } \langle i, j \rangle \notin \sigma\}$.

Armed with these two notions, we can define truth-conditional and answerhood-conditional satisfaction. For any information state $\sigma$, point $i$, and proposition (set of points) $s$, we declare that:

- $i \models \sigma$ iff $i \in D(\sigma)$ (truth-conditional satisfaction);

- $s \models \sigma$ iff $(s^2 \cap I(\sigma)) = \emptyset$ (answer-conditional satisfaction).

In the first clause here it is said that the point $i$ satisfies state $\sigma$ if it is not excluded by it. The second clause amounts to the claim that the proposition that $s$, if accepted, eliminates all issues from $\sigma$.

The above notions are embedded in an update semantics, where interpretation proceeds by a stackwise update of common grounds. The local dynamic perspective is concerned with what has been said and asked, and in what way. In terms of Lewis' metaphor, it tells us

what the local score is, or in terms of Ginzburg and Roberts' metaphors, it tells us what the dialogue game-board is. The score, or board, keeps track of the facts that have been established, and the issues which have been raised—and not answered, yet. The main challenge of inquisitive semantics consists in providing a formal characterization of the conditions under which any contribution $n$ to the discourse, or move in the game, may count as a proper answer to, or a contribution congruent with, or compliant with, a previous contribution $n - 1$.

Inquisitive semantics is not (just) about putting utterances together and establishing direct relations between them. It is a theory concerned with the coherent, linguistically motivated, organization of discourse. Notice that it can also be modeled after the format of a dynamic semantics, so, after that of a classical Tarskian satisfaction semantics. Note, as well, that it is focused on the local situation: answerhood, congruence with, or compliance with the current state of the discourse. The relevant notions of satisfaction are always stated in terms of the immediate context.

### 3.2. The Global Variety of GDP

It appears to be a truism that agents always enter a conversation with their own background information, information about the others who have entered, and normally also with their own questions, whether or not they want to see these questions answered. Obviously, this background information and the background issues are relevant to the development of a discourse.

Those working on decision theory and game theory realize that the major question is not, directly, what the world is like, but what one is going to do. Sure enough, any appropriate answer to the question what to do ("Cinema? Beach? Work?") will depend on the question what the world is like ("Is there a nice movie? What is the weather today? When is my deadline?"). In a goal-directed pragmatics one can sensibly reason about informative exchanges, once one realizes that assertions and questions are made against the background of real-life, embodied, agents, who face their so-called 'decision problems'.

Since we conceive of agents as themselves having questions and information, we can quite appropriately model their states as we modeled common grounds. There are data in them and questions, or issues.

The data are modeled by means of the sets of worlds which correspond to the ways the world might be, according to the information of the agent; and the distinctions made are precisely those which matter for the choices the agent has to make in order to plan his or her actions. In a discourse, then, agents may cooperate, or pretend to cooperate, in order to get their questions answered. A most rigid implementation of this idea might consist in agents asking their individual questions, and their respondents answering them. But things do not always work in this transparent way. However, it is expedient to keep to this general, or global perspective. As Craige Roberts puts it: "As in a game, some strategies may be better, some worse (...). Whether strategies are effective involves, as well, an element of luck, as in any inquiry." (Roberts 1996, p. 92) "One advantage of the static characterization is that it offers a more global view, facilitating discussion of properties of InfoStr *per se* (...)." (Roberts 1996, p. 104)

As above, also an agent's state with information and questions can be modeled by a symmetric and transitive relation on a set of possibilities. The modeling of data is truth-conditional, again possible worlds-style. The modeling of issues is, arguably, decision-theoretic. For a person's concerns and decisions *some* differences between points may be irrelevant, *others* are *decisive*. This is precisely what is modeled by these transitive and symmetric relations. Again, a proposition $s$ *satisfies* a question $\sigma$, $s \models \sigma$, iff the information in $s$ removes all issues in $\sigma$, i.e., iff $(s^2 \cap I(\sigma)) = \emptyset$.

Armed with these notions, we can define a notion of an optimal inquisitive discourse, as in Dekker (2007). The idea is that the agents involved in a communication aim to get their questions resolved in a reliable and respectable manner. The following definition rests, again, on a Tarskian notion of satisfaction.

- Let $a_1, \ldots, a_n \in A$ be a set of agents with information states $\sigma_1, \ldots, \sigma_n$, together with an oracle $\mathcal{O} = \sigma_0$; then an inquisitive discourse $\Phi$ is optimal iff:

  - $\bigwedge_{1 \leq i \leq n} (D([[\Phi]]_{\mathcal{M},g}) \models \sigma_i)$      (relation)
  - $D(\bigcap_{0 \leq i \leq n}(\sigma_i)) \subseteq D([[\Phi]]_{\mathcal{M},g})$      (quality)
  - $\Phi$ is minimal and well-behaved      (quantity and manner)

(all relative to some model $\mathcal{M}$, assignment $g$, and world $v$ where those agents have these information states).

The definition is, deliberately, rather formalistic, so as to show that we can make the underlying intuitions precise, and testable. The first clause tells us that a discourse $\Phi$ is optimal only if it answers all of the questions of each of the agents involved. Surely, this is not what always happens, and maybe never, but it is a good ideal to work for. The second clause says that, ideally, the information exchanged in the discourse is information which the agents jointly, and distributively, have. So this may be information that they were not aware of before the exchange, but it is information they can rely on, provided they mutually think they are reliable. The third is as vague as it is meant to be, but not unimportant. In sum, the notion of an optimal inquisitive discourse establishes that the involved agents want to get their questions answered (relation), on the basis of available information (quality), and in a suitable way (quantity and manner). (The labels here are those of Grice, who borrowed them from Kant.)

Before we illustrate the use of this very general definition, it is useful to make some preliminary notes, which may be obvious, but should nevertheless be made explicit. First, a discourse may be optimal, but not accord with the above definition. The obvious reason is of course that agents may have questions which the interlocutors, jointly and distributively, don't have an answer to. And, secondly, agents may of course have reason not to work on an optimal inquisitive discourse as defined above, because they have their own secret agenda. It may still be optimal, to some, or maybe all of the participants. Third, an actually realized discourse may provide its own information, and raise its own issues. This is a methodological issue, which is perhaps not of much philosophical interest, but it is of great practical interest.

A most important thing to note in the context of this paper is that the whole notion is very appropriately stated in terms of truth and answerhood conditions. And, more importantly, it helps to explain why certain exchanges are very reasonable indeed, even though they do not comply with the local pragmatic picture presented in the previous section. Let us go through some, we think natural, examples.

Consider the following exchange.

$A$: Will Bernd be at the reception?

$B$: I don't know. He will be if he finished his grading.

$C$: Oh, but he just finished his grading.

In this, felicitous, exchange, $B$ provides information which is not literally asked for by $A$. Nevertheless, together with $C$'s contribution, it serves to complete the relevant picture and answer the question $A$ has raised. We formally spell this out as follows.

- $\sigma_A \models [[?Rb]]$; $\sigma_B \models [[(Gb \rightarrow Rb)]]$; $\sigma_C \models [[Gb]]$.

$A$ has the question whether $Rb$, whether Bernd will be at the reception. $B$ has the information that $(Gb \rightarrow Rb)$, that he will if he finished his grading. And $C$ has the information that $Gb$, that he finished his grading. The data from the discourse are that Bernd finished his grading, and will come to the reception.

- $D([[?Rb\,;(Gb \rightarrow Rb)\,;Gb)]]) = D([[(Gb \wedge Rb)]])$.

The information provided by the discourse is supported by the distributed, joint, information of $A$, $B$, and $C$.

- $D(\sigma_A \cap \sigma_B \cap \sigma_C) \models D([[(Gb \wedge Rb)]])$.

Moreover, the exchange provides an answer to the only explicit question.

- $[[(Gb \wedge Rb)]] \models [[?Rb]]$.

Now we may wonder, was this exchange optimal? The answer is, yes iff it was well-behaved. The interesting point is that a successful exchange has been achieved by means of $B$'s contribution, which was not an answer, and which was not solicited.

With a global view on discourse, and information exchange, we can not only explain the reasonableness of unsolicited information, but also that of posing questions one does not have. Consider the following exchange.

$A$: Will Bernd be at the reception?

$B$: Did he finish grading the assignments?

$A$: What's that got to do with it?

$B$: My dear, if he didn't, he will surely not be at the reception.

$A$: Well, he didn't.

$B$: Very well, then, he won't be at the reception.

The situation seems to be as follows.

- $\sigma_A \models {?Rb}$; $\sigma_B \not\models {?Gb}$; $\sigma_B \models (\neg Gb \rightarrow \neg Rb)$; $\sigma_A \models \neg Gb$.

  $A$ wonders whether Bernd will be there $?Rb$, and knows that he didn't finish his grading $\neg Gb$. $B$ did not, initially, wonder whether Bernd finished his grading, but he knows that if Bernd didn't, he will not be at the reception $(\neg Gb \rightarrow \neg Rb)$. The data agreed upon are that Bernd didn't finish grading, and will not be at the reception.

- $D([[\Phi]]) = D([[(\neg Gb \wedge \neg Rb)]])$.

This information is supported by the joint, and distributed, information of $A$ and $B$.

- $D(\sigma_A \cap \sigma_B) \models D([[(\neg Gb \wedge \neg Rb)]])$.

And the information exchanged indeed answers the question raised by $A$.

- $[[(\neg Gb \wedge \neg Rb)]] \models [[?Rb]]$.

Again, was this optimal? Again, yes, iff $B$ was definitely well-behaved. The interesting thing is that in this example $B$ has raised a question, which he didn't have himself before $A$ raised his question about Bernd.

Let us now turn to a final example where a question is reasonably posed, which is more inquisitive than what one wants to know. Imagine the real life question, will you go to the reception tonight? Practically this means that you wonder whether you are in a $+$ world, where it is good to go to the reception, or in a $-$ world, where it doesn't really make sense to go there. Effectively, this is a polar (*Yes/No-*)question. The relevant parameters for you consist in the attendance of professors Arms ($A$), Baker ($B$), Charms ($C$), and Dipple ($D$). You would like to talk to professors $A$ and $C$, but there are some complications. If, besides professor $A$, professor $B$ is there as well she will absorb $A$, if $B$ doesn't absorb professor $C$, that is, if $C$ is not absorbed by professor

$D$; furthermore, if neither $B$ and $C$ are present, $D$ will absorb $A$. These things happen. The sixteen possible configuration of attendance by $A$, $B$, $C$, and $D$, and your preferences, are given by the following table.

- 

|  | $C\&D$ | $C\&\neg D$ | $\neg C\&D$ | $\neg C\&\neg D$ |
|---|---|---|---|---|
| $A\&\ B$ | - | + | - | - |
| $A\&\neg B$ | + | + | - | + |
| $\neg A\&\ B$ | - | - | - | - |
| $\neg A\&\neg B$ | - | + | - | - |

To be clear, your decision problem is whether or not you have to dress up for a reception tonight. You could ask me:

- Will I go to the party?

But that is quite silly of course. You could also ask me whether we are in a $+$ or $-$ configuration, because that is what is decisive. One way of doing that is by asking a polar (*Yes/No-*)question. For instance, here is the simplest one I could come up with.

- (A and ((not-B and (if D then C)) or (B and C and not-D))) or (C and not-B and not-D)?

If I would say "Yes", you would know you should go there, and if I said "No", you shouldn't. But maybe I would not even know about all four of them. Instead, you could ask a more practical question.

- Who (of $A$, $B$, $C$, and $D$) plan to come?

I might give a partial answer to this, for instance.

- Arms will not come, but Baker will.

I may not know it, but this would be sufficient for you. You don't have to spoil your evening, and decide you can work at home. The point of this example is that your question, explicitly stated, was asking for more information than you required. You asked regarding each of the four whether they would come, while you only wanted to know whether it was $+$ or a $-$ configuration of the professors who come. Nevertheless, your question, and my non-complete answer to it, sufficed to settle the matter. The reason, or explanation, is not that you

asked for information you needed, but that, given the general, and global perspective, this was the most efficient way to solicit information that you did need.

The more general moral of the previous investigations is that, first, the notion of an optimal inquisitive discourse is not a normative or empirical idealization. But it serves to set guidelines for understanding or helping to try and understand real-life pieces of discourse. Also it can be modeled after the format of an inquisitive, a dynamic, or indeed a classical Tarskian satisfaction semantics. In sum, TCS × GDP, the product of truth-conditional semantics and goal-directed pragmatics, with all its subdisciplines, still seems to be philosophically motivated, conceptually coherent, and empirically successful.

## 4. ON CONTEXTUALISM

It may appear from the preceding sections that we are indeed quite positive about the enterprise of formal, truth-conditional semantics, and formal, goal-directed pragmatics. We believe there to be many structural phenomena, both in semantics and pragmatics, that are there to be uncovered. This optimism is not generally shared, though, and more pessimistic sounds have been heard from so-called contextualists. Before we begin with answering contextualist objections, who, we agree, make all the right observations, it seems appropriate to point out that the phenomenon of context dependence itself is not exclusively the contextualist's domain.

Gottlob Frege, the founder of the philosophy of language, and one of the founders of predicate logic, himself recognized the context-dependence of natural language. But, indeed, he sought to eliminate it. Bertrand Russell recognized it too, and indeed emphasized its epistemological importance. And the later Wittgenstein also focused on context-dependence, and its importance, in epistemology and the philosophy of language. What are called 'contextualists' nowadays also embrace context-dependence, but they use it to argue against any form of semantics in the spirit of Frege and Russell, and also Carnap, Tarski, Montague, and all the others who have revealed so much of the structure of natural language.

The change in perspective is aptly summarized in the quote from Borg (2007) at the start of this paper. François Recanati has put it thus: "This difference between natural language and a certain type of formal language is well-known, and no one has ever attempted to deny it. But there is disagreement as to the importance of the distinction. Contextualists hold that the difference between the two types of language is all-important; natural-language sentences, according to them, are essentially context-sensitive, and do not have determinate truth-conditions." (Recanati 1994, p. 157) The idea is that in the actual interpretation of natural language so much is un- or under-determined, that it doesn't seem to make any sense to even begin with trying to set up a theory of cross-contextual 'meaning'.

Contextualists often, rightly, relate to the later Wittgenstein, who is, by the way, very informative in this respect. Ludwig Wittgenstein Wittgenstein (1953) makes two points which one should take to heart. First, and as against the early Wittgenstein, he does not maintain, any longer, that there is, or should be, an ultimate logical analysis of any sentence, proposition, or thought. Bluntly speaking, we clearly can do without. By the same token, he emphasizes that sentences, propositions and thoughts, work, under ordinary circumstances. One of his examples is that of the 'Wegweiser', or road indicator. Pending all possible kinds of vagueness, and all irrelevant philosophical wise-cracks, and simply assuming normal circumstances, the road indicator does or does not indicate the right directions.

"Also kann ich sagen, der Wegweiser läßt doch keinen Zweifel offen. Oder vielmehr: er läßt manchmal einen Zweifel offen, manchmal nicht. Und dies ist nun kein philosophischer Satz mehr, sondern ein Erfahrungssatz." ("So I can say, the road indicator does not leave any doubt. Or, better, it often leaves some doubt, and often it does not. And this is no longer a philosophical statement, but an empirical one.") (Wittgenstein 1953, §85) In normal circumstances, a non-deviant road indicator is perfectly okay; we all know how to read it, how to act upon what it signals, in most of our run of the mill activities in everyday life. In all normal circumstances, der Wegweiser has clear correctness conditions: a number of $n$ directions to point at, and a number of $n$ pointers; why shouldn't we call these conditions truth conditions? One question is, what is normal here? But as Wittgenstein says, every analysis comes to an end, not because it is the final analysis, but because we sim-

ply stop there. "Nun, ich nehme an, er handelt, wie ich es beschrieben habe. Die Erklärungen haben irgendwo ein Ende." (Wittgenstein 1953, §1) We believe this is old, and solid, wisdom. The question is, does it threaten the TCS×GDP enterprise? Some philosophers appear to think so.

François Recanati's arguments take their cue from the following examples, and many many more besides.

- The car is red.

- The apple is red.

- The light is red.

His main point is that the attribution of red, or the predication of 'red' is different in these examples, and maybe in all.

> To fix the utterance's truth-conditions, we need to know something more, something which the meanings of the words do not and cannot give us: we need to know what it is for that thing (or for that sort of thing) to count as being that colour. What is it for a car, a bird, a house, a pen, or a pair of shoes to count as red? To answer such questions, we need to appeal to background assumptions and world knowledge. (Recanati 2005, p. 183)

It is not difficult to come up with examples that show that not only predication, but also reference, quantification, and probably conjunction, will have to be assigned a contextually dependent interpretation. "Contextualism holds that what is said depends on the context of utterance. The evidence in favor of contextualism is provided by indefinitely many examples in which the same sentence [or predication, . . . , PD], which does not seem to be ambiguous, is used in different contexts to say different things." (Recanati 1994, p. 164) "According to these philosophers, sentences can never express complete propositions independent of context, however explicit speakers try to be. In other words, content is always under-determined by the linguistic material." (Recanati 2006, p. 23) " Contextualism ascribes to modulation a form of necessity which makes it ineliminable. *Without con-textual modulation, no proposition could be expressed*—that is the gist of contextualism." (Recanati 2005, p. 179–80)

Recanati's observations are all very acute, and right, but one may wonder whether they are to the point. Context-dependence has been recognized for a long time, and I have received my linguistic training under the permanent conviction that all language use is context dependent. Nevertheless, people succeed and keep on succeeding, in detecting structural properties of languages, meanings, and interpretations. These need not be universal properties, as Leibniz or Chomsky may have wanted to have them, but they are structural regularities. Martin Stokhof acutely observed: "A formal language is a tool, a means to provide a 'perspicuous representation' of some aspect of a natural language, a way of laying out certain properties and relations that makes them accessible, amenable to a certain use, i.e., that serves a practical purpose. But we should not forget that natural languages render the same service to formal languages: they, too, need to be explained, made accessible, be applied. And a natural language is often the best tool for that practical purpose." Stokhof (2007) This quote may be taken to challenge the enterprise of formal semantics, and that of formal pragmatics, but also to motivate it in its original, not idealized form. Formal languages should not be taken to be substitutes for natural languages, because then we would fall in a bottomless trap of explaining them. Rather, they can be conceived of as dialects of natural language whose analysis or meanings are, relatively, clear and transparent.

The inherent problem with the contextualist philosophy of language is basically that it appears to deny the existence of content, whereby it robs itself of the possibility of making any substantial claims. According to Herman Cappelen and Ernie Lepore, one of the hallmarks of radical contextualism is the claim that "No English sentence S ever semantically expresses a proposition. Any semantic value that Semantic Minimalism assigns to S can be no more than a *propositional fragment* (or radical), where the hallmark of a propositional fragment (or radical) is that it does not determine a set of truth conditions, and hence, cannot take a truth value." (Cappelen & Lepore 2005, p. 6) Peter Pagin and Jeff Pelletier comment "If radical contextualism is true, systematic semantics is not possible, since, according to [(Cappelen & Lepore 2005, p. 6)], there cannot be any systematic theory of speech act content." (Pagin & Pelletier 2007, abstract of the manuscript) Cap-

pelen and Lepore in the same spirit argue that radical contextualism is internally inconsistent. "To interpret the sentences that express RC [Radical Contextualism, PD] you have to assume that RC is *not* true." (Cappelen & Lepore 2005, extensively discussed on pp. 128–139) For these sentences have to be understood as generic categorial claims about inherent context dependence, but they are meant to be understood as stating a cross-contextual truth. It seems it acts on the borderline between the liar paradox and Moore's paradox as if it claims "What I now say is meaningless." This statement is not a paradox in itself, but it should be taken to be meaningful and false. It is false because it denies the zero-th dogma of empiricism: that there are truth conditions. The statement can be false because it is meaningful.

In the so-called contextualist debate (which is not much of a debate, but rather a clash of opinions), the contextualist position can appropriately be called a nihilist one. Instead of shutting up it says "Shut up." Their target, however, is not favorable either. Those who defend themselves against the contextualists, and who are called, or call themselves, 'minimalists', tend to favor a position where there is a true, minimal, non-contextual core of meaning to be preserved, as in a nature reserve—which is quite non-natural indeed. It seems Emma Borg, Herman Cappelen and Ernie Lepore, Peter Pagin, Jeff Pelletier, Jason Stanley and Zoltan Szabo entertain such a minimalist position. The envisaged notion of meaning, as aptly coined "the myth of the museum" by Quine, indeed seems to have outlived itself, as the contextualists claim, and minimalistically denying this fact seems like a form of escapism. A typical example of this kind of escapist defense we can find in the formal and compositional semantics proposed in Pagin & Pelletier (2007), where the contextualists are allowed to move in at every node in any analysis tree.

We believe that such a defensive attitude is not called for. A system of formal semantics (including a system of formal pragmatics) reveals significant structural properties of the interpretation of natural language. This more modest attitude is also found in Cappelen and Lepore: "Even if the output of linguistic activity (i.e., what was said, meant, asserted, claimed) is, as we have argued, context sensitive to the extreme, it does not follow that there is nothing general, systematic, or non-context sensitive to resolve about how we determine

what-was-said (or meant, asserted or claimed." (Cappelen & Lepore 1997, p. 293) We agree, and this is, already, more than the observation that no analysis is possible. The rules, possibly partially active, concern constraints employed or displayed by embodied cognitive agents in a social environment, which are active in conjunction with all kinds of other bodily, cognitive, and social constraints, in a natural, i.e., *normal* situation. If one develops a formal language, or a formal system of interpretation, these are systems which are abstract models of certain structural aspects of a kind of social behavior. One does not need to claim that these are constitutive properties of language; nor that these are part of a true cognitive competence in the brain; nor that these provide an explanation of the philosopher's nightmare about 'meaning'. They can be conceived to be like models in economics, sociology, biology. This is why, coincidentally, they are appropriately called 'models'. Modestly conceived, this enterprise has very well started as a semantic theory of truth: which is philosophically as neutral as possible, which has an empirically wide scope, and which proves cross-linguistically viable. We hope it continues to do so.

### 5.   CONCLUSION

To conclude the findings of this status report, I can still see many arguments in favor of the TCS × GDP enterprise. It is philosophically well-motivated, it is formally well-defined, and it is the only enterprise, except perhaps stochastic enterprises, that uncovers structural properties of natural language. Interestingly, these properties are not only valuable from a linguistic perspective, but they are also interesting for the philosophy of mind, the philosophy of science, and the philosophy of ethics, perhaps.

In addition, I have reported, and so I hope I have convinced the reader, justified criticism of an overly optimistic and outdated interpretation of this enterprise. The main point of the paper, however, is that these criticisms do not affect the enterprise, when modestly conceived.

## References

Asher, Nicholas & Lascarides, Alex. 1998. 'Questions in Dialogue'. *Linguistics and Philosophy* 23: 237–309.

Borg, Emma. 2007. 'Minimalism versus contextualism in semantics'. In Gerhard Preyer & Georg Peter (eds.) 'Context-Sensitivity and Semantic Minimalism', pp. 339–359. Oxford: Oxford University Press.

Cappelen, Herman & Lepore, Ernest. 1997. 'On an Alleged Connection between Indirect Quotation and Semantic Theory'. *Mind and Language* 12: pp. 278–296.

Cappelen, Herman & Lepore, Ernie. 2005. *Insensitive Semantics*. Oxford: Blackwell.

Dekker, Paul. 2002. 'Meaning and Use of Indefinite Expressions'. *Journal of Logic, Language and Information* 11: pp. 141–194.

——. 2004. 'Grounding Dynamic Semantics'. In Anne Bezuidenhout & Marga Reimer (eds.) 'Descriptions and Beyond: An Interdisciplinary Collection of Essays on Definite and Indefinite Descriptions and other Related Phenomena', Oxford: Oxford University Press.

——. 2007. 'Optimal Inquisitive Discourse'. In Maria Aloni, Alastair Butler & Paul Dekker (eds.) 'Questions in Dynamic Semantics', CRiSPI 17, pp. 83–101. Amsterdam: Elsevier.

Frege, Gottlob. 1892. 'Über Sinn und Bedeutung'. *Zeitschrift für Philosophie und philosophische Kritik* NF 100: pp. 25–50.

Ginzburg, Jonathan. 1995. 'Resolving Questions, I & II'. *Linguistics and Philosophy* 18, no. 5,6: pp. 459–527 and 567–609.

——. To appear. *The Interactive Stance: Meaning for Conversation*. Oxford: Oxford University Press.

Groenendijk, Jeroen. 1999. 'The Logic of Interrogation'. In T. Matthews & D. Strolovitch (eds.) 'Proceedings of SALT IX', Also appeared in Aloni, M., Butler, A., and Dekker, P., 2007, *Questions in Dynamic Semantics*, CRiSPI, Elsevier.: CLC Publications.

Groenendijk, Jeroen & Roelofsen, Floris. 2009. 'Inquisitive Semantics and Pragmatics'. In Jesus M. Larrazabal & Larraitz Zubeldia (eds.) 'Meaning, Content, and Argument: Proceedings of the ILCLI International Workshop on Semantics, Pragmatics, and Rhetoric', Bilbao: University of the Basque Country Press.

Groenendijk, Jeroen & Stokhof, Martin. 1991. 'Dynamic Predicate Logic'. *Linguistics and Philosophy* 14, no. 1: pp. 39–100.

Hulstijn, Joris. 1997. 'Structured Information States. Raising and Resolving Issues'. In Anton Benz & Gerhard Jäger (eds.) 'Proceedings of MunDial97', pp. 99–117. University of Munich.

Jäger, Gerhard. 1996. 'Only Updates. On the Dynamics of the Focus Particle *only*'. In Mar-

tin Stokhof & Paul Dekker (eds.) 'Proceedings of the Tenth Amsterdam Colloquium', pp. 387–405. Amsterdam: ILLC, University of Amsterdam.

Lascarides, Alex & Asher, Nicholas. 2009. 'The Interpretation of Questions in Dialogue'. In Arndt Riester & Torgrim Solstad (eds.) 'Proceedings of Sinn und Bedeutung 13', 17–30. Stuttgart: IMS.

Lewis, David. 1970. 'General Semantics'. *Synthese* 22: 18–67.

Montague, Richard. 1974. 'English as a Formal Language'. In Richmond Thomason (ed.) 'Formal Philosophy. Selected papers of Richard Montague', pp. 188–221. New Haven: Yale University Press. Originally published in Bruno Visentini (et al.), 1970, *Linguaggi nella Società e nella Tecnica*, Edizioni di Comunità, Milan, pp. 189–224.

Pagin, Peter & Pelletier, Francis Jeffry. 2007. 'Content, context, and composition'. In Gerhard Preyer & Georg Peter (eds.) 'Context-Sensitivity and Semantic Minimalism', pp. 25–62. Oxford: Oxford University Press. Original manuscript, 2006, with abstract: `http://people.su.se/~ppagin/papers/jeffandpeter10.pdf`.

Partee, Barbara H. 1973. 'Some transformational extensions of Montague grammar'. *Journal of Philosophical Logic* 2: 509–534.

——. 2004. 'Reflections of a Formal Semanticist'. In Barbara H. Partee (ed.) 'Compositionality in Formal Semantics', Oxford: Blackwell.

Partee, B.H. 1979. 'Semantics — mathematics of psychology?' In Rainer Bäuerle, Urs Egli & Arnim von Stechow (eds.) 'Semantics from different points of view', pp. 1–14. Berlin: Springer-Verlag.

Quine, Willard Van Orman. 1960. 'Translation and Meaning'. In W.V.O. Quine (ed.) 'word and Object', Cambridge: MIT Press.

——. 1987. 'Indeterminacy of Translation again'. *Journal of Philosophical Logic* 84: 5–10.

Recanati, François. 1994. 'Contextualism and Anti-Contextualism in the Philosophy of Language'. In S. L. Tsohatzidis (ed.) 'Foundations of Speech Act Theory: Philosophical and Linguistic Perspectives', London and New York: Routledge. Pp. 156–66.

——. 2005. 'Literalism and contextualism: Some varieties'. In Gerhard Preyer & Georg Peter (eds.) 'Contextualism in Philosophy: Knowledge, Meaning, and Truth', pp. 171–196. Oxford: Oxford University Press.

——. 2006. 'Crazy Minimalism'. *Mind and Language* 21, no. 1: pp. 21–30.

Roberts, Craige. 1996. 'Information structure in discourse'. In J. H. Yoon & A. Kathol (eds.) 'Working Papers in Linguistics 49', pp. 91–136. Ohio State University.

——. 2004. 'Context in dynamic interpretation'. In Laurence Horn & Gregory Ward (eds.) 'Handbook of Contemporary Pragmatic Theory', Blackwell.

Stanley, Jason. 2005. 'Semantics in context'. In Gerhard Preyer & Georg Peter (eds.) 'Contextualism in Philosophy: Knowledge, Meaning, and Truth', pp. 221–253. Oxford: Oxford University Press.

Stokhof, Martin. 2007. 'Hand or Hammer'. *The Journal of Indian Philosophy* 35: pp. 597–626.

Tarski, Alfred. 1944. 'The Semantic Conception of Truth and the Foundations of Semantics'. *Philosophy and Phenomenological Research* 4.

Wittgenstein, Ludwig. 1922. *Tractatus Logico-Philosophicus*. Oxford: Routledge and Kegan. Originally appeared in 1921 as Logisch-Philosophische Abhandlung in the Annalen der Naturphilosophie, 14.

——. 1953. *Philosophische Untersuchungen/Philosophical Investigations*. Oxford: Blackwell. Translation by G.E.M. Anscombe.