Jigsaw Semantics
or:
Dynamic Semantics Put Together Again

Formal Semantics and Pragmatics: Discourse, Context, and Models

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Introductory Notes

- Formal semantics and formal pragmatics:
  - the disciplines are much scattered and
  - seriously challenged, or so it seems.
- We can give up, or reply:
  - unite and meet the challenges.
- Quantitatively speaking, this talk may have practically zero content for this very audience.

Introductory Notes (Cont'd)

- My opinion on, and not an answer to, a question Barbara has addressed years ago:
  - I don't think semantics is a branch of mathematics, nor that it should be.
  - I don't think semantics is a branch of psychology, nor that it should be.
  - I also do not think that semantics is a branch of physics, or that it should be.

Overview and Aims

- Truth-conditional semantics:
  - locally viewed;
  - globally viewed.
- Goal-directed pragmatics:
  - locally viewed;
  - globally viewed.
- Note: informative and inquisitive goals only.
- Aims:
  - work towards a broad coherent concept of interpretation, and
  - answer the good-old contextualists.

Gottlob Frege (1892) *Über Sinn und Bedeutung*

- 'Sinn' is an 'Art des Gegebenseins' of a 'Bedeutung'. In the case of a sentence: a 'Gedanke' and a 'Wahrheitswert', respectively.

Warum genügt uns der Gedanke nicht? Weil und soweit es uns auf seinen Wahrheitswert ankommt.
Ein Urteil ist mir nicht das bloße Fassen eines Gedankens, sondern die Anerkennung seiner Wahrheit.
So werden wir dahin gedrängt, den Wahrheitswert eines Satzes als seine Bedeutung anzuerkennen.

- 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 (1922) *Logisch-Philosophische Abhandlung*

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. (4.024)

- Pushing Frege and Wittgenstein to the limit: meanings *are* truth conditions.

Alfred Tarski (1944) *The Semantic Conception of Truth and the Foundations of Semantics*

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.

(. . .) we wish to use the term "true" in such a way that all equivalences of the form (T) 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.

All [semantic] notions mentioned in this section can be defined in terms of satisfaction.
(This is on *truth*, but also, *designates*, *define*, *consequence*, and *synonymity*.)

Willard V.O. Quine (1960, 1987)

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.
(*Word and Object*, Ch. 2, "Translation and Meaning")

There is nothing in linguistic meaning, then, beyond what is to be gleared from overt behavior in observable circumstances.
("Indeterminacy of Translation Again")

- Pushing Quine and Tarski to the limit: meaning, if anything, is nothing but truth-, or satisfaction conditions.

Richard Montague, David Lewis, Barbara Partee

(. . .) 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. (Richard Montague, "English as a formal language", 1970)

Semantics with no treatment of truth conditions is not semantics. (David Lewis, "General Semantics", 1971)

(. . .) an essential part of semantics is the construction of a theory of truth for a language. (Barbara Partee, "Extensions", 1973)

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. (Barbara Partee, "Reflections", 2004)

Moral

- All the work in truth-conditional semantics is exciting and valuable and promising.
- There is no reason to suppose that any of the truth-conditional analyses offered, or any of those still to be offered, are wrong because they are well-formulated.
- Principally, they are concerned with all and only the empirically generalizable data.
- Psychological and sociological theories of meaning are trivial or circular.
  - But that's something for another occasion.

Wittgenstein Again

(and Not only Wittgenstein)

2.1 Wir machen uns Bilder der Tatsachen.

2.12 Das Bild ist ein Modell der Wirklichkeit.

- Note: we make ourselves, sometimes huge, interconnected representations of reality, of all kinds, pictorial, schematic, musical notation, chord schemes, and linguistic, ...
- How do we communicate them?
  - In bits and pieces.

≫ Here lies a problem of decomposition and reconstruction.

- There is the task of establishing connections in scattered representations, which may very well be modeled on the technique of establishing anaphoric relationships in discourse.

Discourse Representation Theory

- Just an example:
  - A man who is walking runs away from a dog he sees.
- $\exists x((Mx \wedge Wx) \wedge \exists y((Dy \wedge Sxy) \wedge Rxy))$.

In a *DRS*:

x	y	
Mx	Dy	
Wx	Sxy	Rxy

- How may we communicate this in bits and pieces?

Linguistic Decomposition

1. A man was walking in the park.
2. He saw a dog.
3. He ran away from it.

- Discourse representational theoretic decomposition:

x_1	y_2	
Mx_1	Dy_2	
Wx_1	Sx_2y_2	Rx_3y_3

- Discourse representational theoretic reconstruction:

$$x_1 = x_2 = x_3 \text{ and } y_2 = y_3.$$

- This should go for any kind of connections in discourse or representation:
  - identity, anaphora, causal, temporal and discourse relations, ...

Markerese and Mentalese

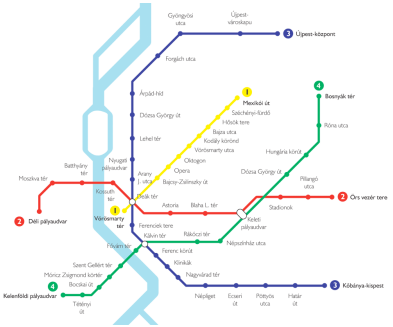
- There is a reason not to be satisfied with the picture.

Translation into Markerese is at best a substitute for real semantics.
(David Lewis, 1971)

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 and Stokhof, *DPL*, 1987)

- How to communicate pictures, paintings, schemes, and feelings, which are not discourse representation structures?

Budapest Metro



- Metro Stations standing in direct and indirect connections, and standing in spatial relations with one another.
- What this picture displays, can only be adequately captured by means of the right truth-conditions. What else?
- If $i \models$ `BudapestMetro.png` then $i \models \exists x(STATx \wedge \exists 3y(LINEy \wedge ONxy))$.

Dynamic Predicate Logic

- *DPL* succeeds in associating all three separate sentences in the above example, with an independent meaning, in terms of input-output-conditions.
- The most inspiring 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.
- $\langle g, h\rangle \in [\![\exists y(Dy \wedge Sxy)]\!]$ iff
  - $g[y]h$ and $h(y)$ is a dog such that $g(x)$ sees $g(y)$.
- This is so verifying!

Is DPL Non-Representational?

- Does *DPL* really answer the representationalist challenge?
- What gets modeled in *DPL* is "a fact about the conversation, and not about the subject matter" (Stalnaker, 1998), or "Discourse information of this type looks more like a book-keeping device, than like real information." (Groenendijk, Stokhof and Veltman, 1996)
- Should this motivate a change in our concept of meaning, or information?
- As *DPL* shows (indeed: proves) that we are not committed to a representational theory of meaning, so *PLA* shows (indeed: proves) we are not committed to a dynamic concept of meaning.

Predicate Logic with Anaphora

- *PLA* is a semantic system that covers *DRT* and *DPL* results, and it is just a Tarskian satisfaction system for a logical language with pronouns.
- The system employs satisfying witnesses for singular and plural terms referred to in discourse.
- The dynamics of interpretation are entirely covered by a dynamic notion of conjunction, which basically pays duty, only, to the idea that a conjunction has a first, and a last conjunct;
  - the idea that, before a conjunction, the first conjunct will be coming first, and after the conjunction, the second has come last.

PLA Illustration

- 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.
- A sequence $de \ldots \models (\exists x(Mx \wedge Wx)\ ;\ \exists y(Dy \wedge S\mathtt{p}_1 y))$ iff
  - $e \ldots \models \exists x(Mx \wedge Wx)$ and $de \ldots \models \exists y(Dy \wedge S\mathtt{p}_1 y)$ iff
    e is a man who walks in the park, and d is a dog which e sees.
- This is so satisfying!
- A situation, or better, a sequence of witnesses, which satisfies ($\models$) the Budapest map, will satisfy ($\models$)
  - $\exists x(STATx \wedge \exists 3y(LINEy \wedge ONxy))$.

Moral

- All the work in truth-conditional semantics is still exciting and valuable and promising.
- All the work in dynamic semantics is also exciting and valuable and promising.
- Dynamic semantics is not (just) about anaphoric relationships.
- It is a program for understanding the structured exchange of complex information in discourse.
- And it can be modeled on the preliminaries of a good old Tarskian satisfaction semantics.

Structuring Discourse in Multilogue

- Building on Stalnaker's notion of a common ground, or a context set, and on its updates, Ginzburg, Roberts, Asher and 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.
- Jonathan Ginzburg, "Resolving Questions", 1995; "The Interactive Stance", 2009;
- Craige Roberts, "Information Structure", 1996/8; "Context in Dynamic Interpretation", 2004;
- Nicholas Asher and Alex Lascarides, "Questions in Dialogue", 1998; "The Interpretation of Questions in Dialogue", 2009.

Interpretation and Action

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 (. . .). (Craige Roberts, 1996/8)

Questions Under Discussion

- 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.
- From close-by, 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.
- From a distance, however, a truth-conditional, or satisfaction, approach still seems to remain a motivating and unifying common thread. There is at worst indeterminacy of mutual translation.

Inquisitive Semantics

- Inquisitive semantics has grown out of the logic of interrogation, which was inspired by Gerhard Jäger's integrated dynamic semantics satisfaction of questions and assertion ("Only Updates", 1996) and Joris Hulstijn's program of "Raising and Resolving Issues in Discourse " ("Structured information states", 1997).
- Jeroen Groenendijk, "The Logic of Interrogation", 1999; Jeroen Groenendijk and Floris Roelofsen, "Inquisitive Semantics and Pragmatics", 2009; Jeroen Groenendijk, "Radical Inquisitive Semantics", Amsterdam, Copenhagen, Riga, 2010.

Information, Issues and Updates

- Common grounds σ model data and issues, as a symmetric and transitive relation over worlds / situations / satisfaction points.
- Any related point is considered possible, and two unrelated points considered possible constitute an issue:
  - $D(\sigma) = \{i \mid \langle i, i\rangle \in \sigma\}$;
    $I(\sigma) = \{\langle i, j\rangle \mid i, j \in D(\sigma), \text{ and } \langle i, j\rangle \notin \sigma\}$.
- $i \models \sigma$ iff $i \in D(\sigma)$ (truth-conditional satisfaction);
- $s \models \sigma$ iff $(s^2 \cap I(\sigma)) = \emptyset$ (answer-conditional satisfaction).

Updates, Stacks, and Satisfaction

- 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.
  - What is the Lewisian score?
  - What does the Dialogue Game-Board tell us now?
  - Is this contribution n an answer to, congruent with, or compliant with, a previous contribution $n-1$?
- Main issue: Does the contribution serve to satisfy the current state?

The Local Perspective

- Inquisitive semantics is not (just) about clicking utterances together.
- It is a theory concerned with the coherent, linguistically motivated, organization of discourse.
- Note: it is focused on the local situation: answerhood, congruence with, or compliance with the current state of the discourse.

Moral

- All the work in truth-conditional semantics is still exciting and valuable and promising.
- All the work in dynamic semantics is still exciting and valuable and promising.
- All the work in inquisitive semantics is also exciting and valuable and promising.
- And it can be modeled on the preliminaries of a dynamic semantics, so, of a good old Tarskian satisfaction semantics.

A Global Perspective

- Agents themselves have questions and information.
- Information about what the world is like, and questions as to how it is like, so as to make their decisions.
- The Big Question is: "What To Do?"
  - Cinema, or beach, or stay home and work?

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. (...) One advantage of the static characterization is that it offers a more global view, facilitating discussion of properties of InfoStr per se (...) (Craige Roberts, "Information Structure", 1996/8)

- Agents participate in conversations, partly, to get their questions answered.

Information, Questions and Answerhood

- 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 / 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 relations.

Optimal Inquisitive Discourse

- The agents involved in a communication aim to get their questions resolved in a reliable and respectable manner.
- 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 Φ 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)
  - Φ is minimal and well-behaved (quantity and manner)
- The agents want to get their questions answered (relation), on the basis of available information (quality), and in a suitable way (quantity and manner).

Some Notes

- Note: a discourse may provide its own information, and raise its own issues.
- Note: an optimal inquisitive discourse can be impossible.
- Note: it need not be your purpose to achieve an OID.
- Note: you can be irrational or unncooperative if you want.
- But: all of this is very appropriately stated in terms of truth and answerhood conditions.

Illustration: Providing Unsolicited Information

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.

- $\sigma_A \models ?Rb$; $\sigma_B \models (Gb \rightarrow Rb)$; $\sigma_C \models Gb$.
- $D([\![?Rb\ ;\ (Gb \rightarrow Rb)\ ;\ Gb)]\!]) = D([\![(Gb \wedge Rb)]\!])$;
- $D(\sigma_A \cap \sigma_B \cap \sigma_C) \models D([\![(Gb \wedge Rb)]\!])$;
- $[\![(Gb \wedge Rb)]\!] \models [\![?Rb]\!]$.
- Was this optimal?
- Iff it was well-behaved.

Illustration: Asking Questions One Does Not Have

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.

- $\sigma_A \models ?Rb$; $\sigma_B \not\models ?Gb$; $\sigma_B \models (\neg Gb \rightarrow \neg Rb)$; $\sigma_A \models \neg Gb$.
- $D([\![\Phi]\!]) = D([\![(\neg Gb \wedge \neg Rb)]\!])$;
- $D(\sigma_A \cap \sigma_B) \models D([\![(\neg Gb \wedge \neg Rb)]\!])$;
- $[\![(\neg Gb \wedge \neg Rb)]\!] \models [\![?Rb]\!]$.
- Was this optimal?
- B was definitely well-behaved.

Will *I* Go to the Reception?

- All I want to know is if I am living in a + or − world, which corresponds to a positive or negative decision about going to the reception, and which basically is a polar (*Yes/No*-)question.
- The question is essentially about the private plans of the professors Arms (A), Baker (B), Charms (C), and Dipple (D).
	$C\&D$	$C\&\neg D$	$\neg C\&D$	$\neg C\&\neg D$
$A\&\ B$	-	+	-	-
$A\&\neg B$	+	+	-	+
$\neg A\&\ B$	-	-	-	-
$\neg A\&\neg B$	-	+	-	-

Will *I* Go to the Reception? What to ask?

- I could ask my real question:
  - Will I go to the party?
- I could also pose my question in a truth-conditional formulation:
  - (A and ((not-B and (if D then C)) or (B and C and not-D))) or (C and not-B and not-D)?
- Instead, I could ask a more practical question:
  - Who (of A, B, C, and D) plan to come?
- A partial answer to this may be:
  - Arms will not come, but Baker does...

  which is sufficient for me.

Moral

- All the work in truth-conditional semantics is still exciting and valuable and promising.
- All the work in dynamic semantics is still exciting and valuable and promising.
- All the work in inquisitive semantics is still exciting and valuable and promising.
- All the work on optimal inquisitive discourse is also exciting and valuable and promising.

Moral (2)

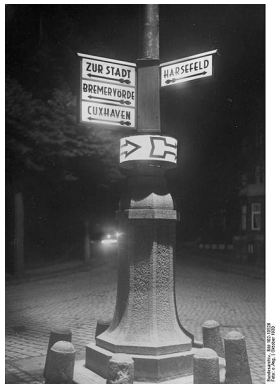
- The notion of an optimal inquisitive discourse is not a normative or empirical idealization.
- It serves to set guidelines for understanding or helping to try and understand real-life pieces of discourse.
- And it can be modeled on the preliminaries of an inquisitive, a dynamic, or a good old Tarskian satisfaction semantics.
- In sum, TCS × GDP, the product of truth-conditional semantics and goal-directed pragmatics, with all its subdisciplines, is
  - philosophically motivated,
  - conceptually coherent,
  - empirically successful, so
  - exciting, valuable, and promising.
- This was part one of the talk.

Context Dependence

- Frege recognized the context-dependence of natural language,
  - but sought to eliminate it.
- Russell recognized it, too,
  - and emphasized its epistemological importance.
- The later Wittgenstein also emphasized its importance,
  - and made it a core feature of his language games.
- 'Contextualists' nowadays also embrace context-dependence,
  - and use it to argue against any form of semantics in the spirit of Frege, Russell, and Carnap, Tarski, Montague, and all the successful others. They abuse the later Wittgenstein for it.

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 favour of contextualism: roughly, the idea that pragmatic effects are endemic throughout truth-evaluable semantic content. (Emma Borg, "Minimalism versus Contextualism", 2007)

Der Wegweiser



- Pending all possible kinds of vagueness, and all irrelevant philosophical wise-cracks, and simply assuming normal circumstances: Der Wegweiser does or does not indicate the right directions, out of three here, it seems.

Wittgenstein Once More

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. (Philosophische Untersuchungen, §85)

- In normal circumstances, a non-deviant road indicator is perfectly alright; 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; n directions to point at, and n pointers; why not call these conditions truth-conditions?
- What is normal here? Every analysis comes to an end, not because it is the final analysis, but because we simply stop there.

Nun, ich nehme an, er handelt, wie ich es beschrieben habe. Die Erklärungen haben irgendwo ein Ende. (Philosophische Untersuchungen, §1)

The Contextualist's Challenge

- Apply these observations to the following examples.
  - The car is red.
  - The apple is red.
  - The light is red.

The evidence in favour 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. (François Recanati, "Contextualism and Anti-Contextualism", 1994)

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. (François Recanati, "Crazy Minimalism", 2006)

- This is all so very right, but structurally not so deeply relevant.

Martin Stokhof, 2007

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. (Martin Stokhof, "Hand or Hammer", 2007)

- The problem with these kinds of statements is that:
  - firstly, it appears they aim to deny the existence of content, so we will never know what the statements' own contents really are;
  - and yet, secondly, they appear to indeed deny the zero-st dogma of empiricism.

The Zero-st Dogma of Empiricism

- There Are Truth Conditions!

The Formal Semanticist's Observation

- First, so-called 'Contextualism' is Nihilism.
- Second, so-called 'Minimalism' is Escapism.

- A system of formal semantics (including a system of formal pragmatics) reveals significant structural properties of the interpretation of natural language.
- They denote 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* environment.

The Formal Semanticist's Reply

- These systems are abstract models of certain structural aspects of a kind of social behaviour.
  - Without claiming these to be the constitutive properties of language;
  - without claiming these to be part of a true cognitive competence in the brain;
  - without claiming to provide an explanation of the philosopher's nightmare about 'meaning'.

- They are like models in economics, sociology, biology, ...

- Such systems have started very well as a semantic theory of truth:
  - philosophically as neutral as possible;
  - with an empirically wide scope;
  - and cross-linguistically viable.

Conclusion

- I can see many arguments in favour of the TCS × GDP enterprise.

- I can see no arguments against the thing.

- I can see a whole lot of

- which I don't like.

Moral

- Many of us emphasize the idiosyncratic properties of their own particular frameworks, as if only their frameworks do their work.

- We should emphasize the truly relevant and unifying features of all frameworks.

- That will be our Framework.