2020 NYU Linguistics seminar

Dynamic Semantics: from content to uptake

3 Feb, First session

Chris Barker, chris.barker@nyu.edu

Version of February 3, 2021, https://github.com/cb125/Dynamics

Plan for today:

1. Preliminaries
2. Framing the seminar
3. Heim 1983
4. micro break (4.5 min)
5. general discussion
6. End at 5:30

Title of today's session: The Quandry of Dynamic Semantics

House rules

1. Seminar github site: https://github.com/cb125/Dynamics
2. I'll talk for a while, sometimes with slides
3. Let's try allowing questions and interruptions throughout
4. Gentle priority for graduate students
5. Slides, code, and papers available on the github site
6. All materials will be updated continuously
7. Let me know if the chat stream gets distracting
8. Let me know if you want to plan a comment or response to a paper later in the semester
9. The syllabus will be constantly updated, but if you want to receive emails about this seminar, send me email, or put your email in the chat stream.

What is dynamic semantics?

Well, what is *semantics*?

- Semantics must *at least* characterize at-issue truth conditions
  - Truth conditions are part of the **content** of an utterance
- **uptake**: how utterances affect the discourse situation, including the beliefs and attitudes of the participants
- All of these details are negotiable, this is just a starting point

What is the difference between *static* and *dynamic* semantics?

- Proposals for criteria for counting as dynamic:
  - Chierchia 95: conjunction is not commutative, i.e., the content of A and B $\neq$ B and A
  - Groenendijk and Stokhof: either not eliminative or not distributive (see below)
  - Rothschild and Yalcin: [it's complicated]
- My starting point:
  - If your semantics explicitly reasons about order of computation, it's dynamic.

Example: arithemetic (turn on screen sharing)

1. $2 + 3 = 9 - 4$

- When computing whether this sentence is true, which subcomputation is executed first?
  - It doesn't matter!
- What about division?

2. $2 + 3 = 9 \;/\; 0$

- Static conception: any sentence involving division by zero is undefined
- But what about coordination?

3. $(2 = 3)$ && $(9 \;/\; 0)$
4. $(9 \;/\; 0)$ && $(2 = 3)$
5. $(2 = 3)$ || $(9 \;/\; 0)$
6. $(2 = 2)$ || $(9 \;/\; 0)$

You might want to allow 3 to be false and 6 to be true. If so, you need a dynamic arithmetic.

Is natural language semantics dynamic?

- I asked this question in 2008. Most people said yes. But it's the wrong question. Here's some wisdom from David Dowty 2007, Compositionality as an Empirical Problem (in Barker and Jacobson (eds), *Direct Compositionality*, OUP):

"Compositionality really should be considered "an empirical question". But it is not a yes-no question, rather it is a "how"-question."

"I propose that we let the term natural language compositionality refer to **whatever strategies and principles we discover that natural languages actually do employ to derive the meanings of sentences**, on the basis of whatever aspects of syntax and whatever additional information (if any) research shows that they do in fact depend on."

"Under this revised terminology, there can be no such things as "counterexamples to compositionality", but there will surely be counterexamples to many particular hypotheses we contemplate as to the form that it takes."

Dynamic semantics as a subproblem of compositionality

- How do natural languages compose meaning?
- In particular, in what order are meanings composed?
- There is undoubtedly a fact of the matter. Possibilities:
  - No constraints: any order of evaluation is allowed
    - Because it makes no difference to the outcome
    - It makes a difference to the outcome, but all of the outcomes are legitimate
  - Left to right (Heim; week 4, Schlenker)
  - Some more complicated rule
- Engineering challenge: how to talk about order of evaluation in static (definitional, equational) terms?

The connection between dynamic semantics and uptake

- Many dynamic semantics offer a different conception of content
  - I.e., instead of truth values, Context Change Potentials (Heim)
  - Relations over sets of assignment functions (DPL)
  - Preference rankings (Starr 2020)
  - etc.
- Sometimes theories explicitly regulate how semantic content affects the state of the discourse (more on this below)
  - Non-negotiable update effects
    - Evidentiality (Murray 2018)
    - Indefinites and discourse referents (Many, with K. Lewis against)

Heim 1983

- Goals for today:
  1. Motivate Heim's project, = model presupposition projection
  2. Understand why Heim turned to context change potential
  3. Refactor the fragment as "classical" in the term of Groenendijk and Stokhof (i.e., make it both eliminative and distributive)
     - show that contra Groenendijk and Stokhof 1990, still dynamic!
- I'll concentrate on presupposition projection, not anaphora

Presupposition projection

How do the presuppositions of a larger clause depend on the presuppositions of its parts?

1. Ann has two kids.
2. Ann's oldest kid is sick.
3. Ann has two kids, and Ann's oldest kid is sick.
4. Ann's oldest kid is sick, and Ann has two kids.

Order matters in English, at least for presupposition projection.

Stalnaker 1973. Presupposition. *Journal of Philosophical Logic* 2: 447–457.

"[T]he basic presupposition relation is not between propositions or sentences, but between a person and a proposition."

"Here is one obvious principle about how pragmatic presuppositions change: after some proposition has been asserted, then the speaker may reasonably presuppose it in subsequent conversation until it is denied, challenged, retracted, or forgotten. If one asserts a proposition using a conjunctive sentence, then according to this simple and obvious principle, the presuppositions will change in the middle of the assertion. The first conjunct will be added to the initial presuppositions before the second conjunct is asserted."

1. Something is changing as time flows
2. It's not the content of the sentences

Karttunen 1974. Presupposition and Linguistic context. *Theoretical Linguistics* 1:181-194.

Heim's paraphrase of Karttunen 74 (her example numbers):

10. If "If A, B" is uttered in context c, then c is the local context for A, and c + A (read: "c incremented by A") is the local context for B.
11. A context c admits a sentence S just in case each of the constituent sentences of S is admitted by the corresponding local context.
12. S presupposes p iff all contexts that admit S entail p.

K: "Once the new sentence has been uttered, the context will be incremented to include the new shared information. Viewed in this light, a theory of presuppositions amounts to a theory of a rational order of contexts from smaller to larger sets of shared information. At each step along the way that a fully explicit discourse proceeds, the current context satisfies the presuppositions of the next sentence that in turn increments it to a new context."

Stalnaker 1979. Assertion.
https://doi.org/10.1002/9780470758335.ch5

1. Let's identify propositions with a set of worlds.
2. Context set: set of worlds, the live possibilities
3. "A conversation is a process taking place in an ever-changing context."
4. The content of a declarative sentence is a proposition.
5. "[H]ow does the content of an assertion alter the context? . . .
   - To make an assertion is to reduce the context set in a particular way. . .
   - [namely,] all of the possible situations incompatible with what is said are eliminated."

Sentence meanings as Context Change Potentials (CCPs)

Heim makes two essential contributions:

1. replacing Karttunen's sets of logical forms with sets of worlds—more knowledge means a smaller context set
2. Making the content of a sentence its typical update effect. (***Yikes!***)

- CCPs are update functions on contexts.
- If c is a context, and A is a sentence, then c + A is an updated context in which the information in A has been added to c
- Heim's promise: merely getting the CCP right simultaneously determines truth conditions and presupposition projection
- Today's perspective: CCPs are engineering designed to force left to right evaluation order

Heim's fragment:

1. Types

```
e            Individual
t            Truth value
s            Possible world
A -> B       Function from As to Bs
[e]          Assignment function (interpreted as Int -> e)
([e] * s)    Evaluation point: (assignment, world)
[([e] * s)]  Context: set of evaluation points

[([e] * s)] -> [([e] * s)] Context Change Potential (CCP)
```

2. Presupposition: some CCPs are undefined on some input contexts. Undefinedness is interpreted as presupposition failure.

3. Heim gives CCPs for certain sentence types:

   - c + "A and B" = (c + A) + B
   - c + "not A" = c\c + A
   - c + "if A then B" = c\(c + A\c + A + B)
   - c + "a_i P Q" = c + P(x_i) + Q(x_i) (presup: i novel)
   - c + "every$_i$ P Q" =

     $$\{(g, w) \in c | \forall a, (g^{i/a}, w) \in c + P(x_i) \rightarrow (g^{i/a}, w) \in c + P(x_i) + Q(x_i)\}$$

4. Novelty: an index i is novel with respect to a context c iff for all g, g' such that g and g' differ only in the value they assign to i, $g \in c \leftrightarrow g' \in c$.

   - let c = [([a,b], w), ([b,b], w)]: then if the domain of discourse is {a, b}, index 1 is novel wrt c, but index 2 is not.

Issue: what about subsentential expressions?

- Think of a name, *Ann*. Can its content be rendered as a CCP? Can you look at an information state and recover Ann's identity? Maybe. Heim doesn't explain how.
- Likewise, *happy*: what is the CCP of a predicate?
- Rough rule: their meanings are whatever they need to be in order to be able to arrive at the correct CCP for the sentences that contain them.
- See the implementation for one possible strategy.

Implementation: discourse about small numbers

- Code available on the github site
- Domain of discourse: the counting numbers 1,2,3,4,5
- Set of live possibilities: w1, w2, w3, w4, w5
  - In the implementation, worlds are simply integers
- Let c1 = [([],1), ([],2), ([],3), ([],4), ([],5)]
- Exactly one world-sentitive predicate, "allowable". Some facts:
  1. c1 + "3 is allowable" = 4 5
  2. c1 + "Not (3 is allowable)" = 1 2 3
  3. c1 + "If (3 is allowable) (2 is allowable)" = 1 2 3 4 5

Presupposition in the implementation

1. c1 + "The even prime is even" = 1 2 3 4 5
2. c1 + "The prime is even" = #
3. c1 + "2 is allowable" = 3 4 5
4. c1 + "Not (3 is allowable)" = 1 2 3
5. c1 + "(2 is allowable) and (Not (3 is allowable))" = 3
6. c1 + "(2 is allowable) and (The allowable prime is even)" = #
7. c1 + "((2 is allowable) and (not (3 is allowable))) and (The allowable prime is even)" = 3
8. c1 + "(The allowable prime is even) and ((2 is allowable) and (not (3 is allowable)))" = #

So order matters: the presuppositions of "A and B" are not the same as the presuppositions of "B and A".

How does it work? c + "A and B" = (c + A) + B First, update with A. Sentence B never sees worlds in which A isn't already true.

Implicit dynamics: evaluate leftmost subexpressions first

G&S 1990/2005 classify dynamic semantics

Assume that we have a formal system that associates expressions with a relation over sets of points (Heim's Context Change Potentials do this).

1. Eliminativity:

$$c + S \subseteq c$$

- Updates only eliminate possibilities, they don't add new ones.

2. Distributivity (pointwiseness):

$$c + S = \bigcap_{c_i \in c} \{c_i\} + S$$

- The update on a set of points depends only on the individiual points, not on properties of the set as a whole.

“Classical” dynamical systems are not “really” dynamic

- G&S call a system that is eliminative and distributive “classical”
- G&S prove if a system is classical, update is equivalent to intersection with the set of points at which the sentence is true.
- "These observations show that a dynamic semantics which assigns only classical updates to sentences **is not really dynamic after all**: it is equivalent with a static semantics with a globally defined notion of update.

Heim's system is "classical" according to G&S

- Eliminative
- As Heim designed it, not distributive
  - The novetly condition on indefinites is a property that no individual evaluation point has, only certain sets of evaluation points.
- However, it is easy to make the system distributive
  - Augment evaluation points with an integer i indicating the lowest unused index
  - Make sure that the starting context provides the fullest range of assignment functions (just as Heim's system must)
  - Evaluating an indefinite uses index i, and increments i for later expressions
  - See implementation of "01-heim-pointwise.hs" on the seminar site [not finished as of 3 feb]
- G&S's conclusion—that Heim's sytem is "not really dynamic after all"—doesn't consider presupposition failure.

But Heim's system is still dynamic in my sense

- G&S's theorems only account for at-issue content, not side effects
- If we restrict Heim's grammar to sentences without presuppositions, G&S would be right: Heim's system would deliver truth conditions equivalent to a "classical" static system.
- But in the presence of side effects–in the current case, presupposition testing–Heim's system makes detailed predictions that are sensitive to the order of subconstituents.

Lewis 1979: Scorekeeping in a Language Game.

- In some ways, the state of a discourse is like the state of a game of baseball.
- There is a scoreboard that tracks various elements
  - who's talking (speaker and hearer)
  - what's in the common ground
  - how much of the question under discussion remains to be addressed
  - etc.
- There is a scoreboard! Handy for tracking uptake.
- There are rules! The relationship between the scoreboard and the content of the discourse is governed by constraints.
- Part of our job as philosophers and linguistis is to figure out those rules

Accommodation

- But there is one characteristic feature of linguistic discourse that is not like, say, baseball.
- If an utterance requires that the context in which it occurs must satisfy a particular presupposition, and it is uttered in a context that does not satisfy that presupposition, then—memorize the magic incantation!: "*ceterus paribus* and within certain limits"—that very presupposition comes into existence at the moment the utterance occurs.
- This would be like a batter walking to first causing the ball count to go from three to four.
- Lewis identifies multiple aspects of language that behave like this: permission, vagueness, etc.

Technical detail: to study anaphora in Heim's model, we need a starting context that is suitable for evaluating indefintes. So

```
let c2 = [([1],1), ([2],1), ([3],1), ([4],1), ([5],1),
          ([1],2), ([2],2), ([3],2), ([4],2), ([5],2),
          ([1],3), ([2],3), ([3],3), ([4],3), ([5],3),
          ([1],4), ([2],4), ([3],4), ([4],4), ([5],4),
          ([1],5), ([2],5), ([3],5), ([4],5), ([5],5)]
```

Now index 1 is suitable to serve as a novel index for an indefinite.

Local accommodation

- We can hope that accommodation will only magically adjust the score in between utterances, and the adjustments that arise from a dynamic treatment of content as uptake run balistically during the evaluation of the utterance without outside interferrence.
- No such luck.

1. c2 + (A_1 prime is even) and (it_1's successor is odd) = [([2],1), ([2],2), ([2],3), ([2],4), ([2],5)]
2. c2 + (A_1 prime is odd) and (it_1's successor is even) = #

- The reason that (2) is predicted infelicitous is that one of the primes in the tiny model (namely, 5) does not have a successor within the domain of discourse.
- Heim's suggestion is that (2) is "amended" to (3):

3. c2 + (A_1 prime is odd) and (it_1 has a successor) and (it_1's succsssor is even) = [([3],1), ([3],2), ([3],3), ([3],4), ([3],5)]

- This is called "local accommodation"

The quandry (the topic of this seminar)

Let's say that we want to track the interaction of various aspects of meaning with context. Such as:

- Presupposition: whether a sentence even has a value depends on how the context evolves during the evaluation of the sentence
- Anaphora: the content of anaphoric expressions depends on how the context evolves during the evaluation of the sentence
  - Indefinites—arguably—affect the context in ways that determine content for downstream anaphors

Then Either...

. . . Then Either:

1. We concentrate on studying how content depends on context, and rely on some extra-linguistic mechanism (general cognition?) to supply us with a mutating context that is in sync with and that depends in part on the ongoing linguistic composition, but on other things as well (*how to we do that?*)

or

2. We bravely attempt to specify exactly how linguistic composition affects the context, ignoring the fact that the Protean context shifts without permission <a goat walks in!> in the middle of our quiet computation (actual language use falls so far short of the ideal typical use. . .)

Harris' assessment of the dilemma

"[T]heories that take publicly shared contexts to play an essential role in the nature of communicative acts or anaphoric dependence conflate an artifact introduced by idealized models of conversation with a feature of the phenomenon being modeled."

"[C]hanging the context is at best a secondary and inessential aim of communicative acts."

- Ouch!
- The word "essential" is important here

Next week: Groenendijk and Stokhof 1991: Dynamic Predicate Logic

G&S dispense with two complicating features of Heim's project:

1. Worlds. Contexts are simply sets of assignment functions
2. Natural language. The mapping between English and the dynamic logic of G&S is illustrated, but not specified

- One topic of special interest in G&S: donkey anaphora

3. If a farmer owns a doney, he beats it.

Preview: the evaluation of the indefinite affects the local context with respect to which the pronouns are evaluated.

Heim and donkey sentences

One of the selling points of Dynamic Predicate Logic is that it accounts for donkey anaphora. So does Heim:

1. c2 + (If (a_1 prime is odd) (it_1's predecessor is even)) = c2