Crossover ii[1]

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[1] 24.979: Topics in semantics
Getting high: Scope, projection, and evaluation order

> Some reminders
>
> If you're a **registered student**, please send us your project proposal by the end of the week.

1 *From continuations to dynamics*

1.1 *Barker & Shan:* WCO *as a reflex of evaluation order*

At the beginning of the semester, we learned about a theory of scope-taking with a built-in left-to-right bias – *continuation semantics*.

Concretely, due to the way that the composition rule Scopal Function Application (SFA) was defined, evaluation of quantificational effects *mirrors* linear order.[2]

[2] To cash this out, we needed to say something concrete about the syntax-semantics interface – concretely, we committed to the ideas that (a) the basic combinatoric operation MERGE is asymmetric, and (b) the syntactic and semantic composition proceed in lockstep (direct compositionality).

As we saw in the last class, an appealing consequence of this linear bias was a natural account of Weak Crossover (WCO) in terms of evaluation order.[3]

[3] See especially Shan & Barker 2006 and Barker & Shan 2014: chapters 2 and 4.

Recall, a simplified version of the WCO paradigm: scope can feed binding (1), unless the binder doesn't precede the bound expression (2).

(1) [Everyone^x's mother] bought them$_x$ a bicycle.

(2) Their$_x$ mother showered everyone^x with gifts.
cf. a different person showered everyone with gifts.

The idea, briefly, was to generalize our notion of a scope-taker to make sense of the idea that pronouns also *scope*.

In Barker & Shan's system, pronouns take scope in the following way: they expect *a proposition*, and they return an *open proposition*.[4]

[4] We can helpfully think of an open proposition in this framework as a proposition with anaphoric effects (i.e., environment sensitivity).

In order for a Quantificational Phrase (QP) to bind a pronoun, it must first be *bind-shifted*. A bind-shifted QP expects an open proposition, and returns a proposition. Successful binding is illustrated in figure 1.

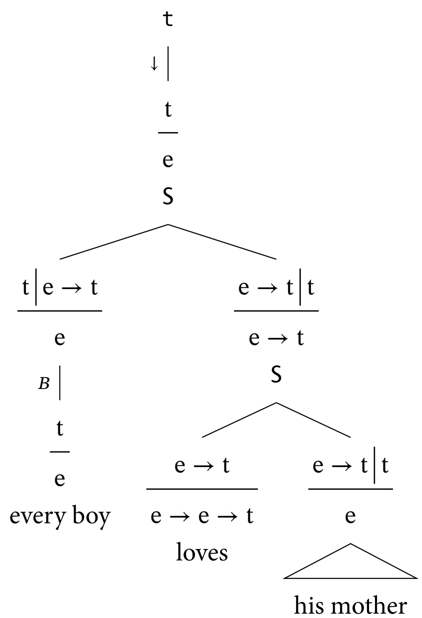

Figure 1: Successful binding

Putting mechanisms for inverse scope to one side, WCO follows straightforwardly from this system. Since both pronouns and bind-shifted QPS are scope-takers, for the pronoun to be bound, the QP has to be evaluated first. Scope can feed binding, but the QP must precede the pronoun, since *evaluation order mirrors linear order*.[5]

[5] One of the virtues of continuation semantics is that it straightforwardly accounts for scope out of Determiner Phrase (DP) without requiring *movement* out of DP.

Continuation semantics includes mechanisms for subverting the linear bias (namely, higher-order continuations), in order to account for inverse scope.

With mechanisms for inverse scope in the picture, things become a little less neat. Barker & Shan (2014) must stipulate that *lower* – the operation via which continuized meaning are collapsed into ordinary meanings – is rigidly typed. If we assume that *internal lower* is derived as lifted *lower*, this also has consequences for its type:

(3) $\downarrow : \dfrac{\mathrm{a} \mid \mathrm{t}}{\mathrm{t}} \to \mathrm{a}$

(4) $\downdownarrows : \dfrac{\mathrm{b}}{\dfrac{\mathrm{a} \mid \mathrm{t}}{\mathrm{t}}} \to \dfrac{\mathrm{b}}{\mathrm{a}}$

This move basically guarantees, via a syntactic stipulation, that in order for a bind-shifted QP to bind a pronoun, it must take scope at the same tower-story as the pronoun. If it takes scope on a high level, then the resulting meaning cannot ultimately be lowered by a rigidly typed *lower*.

An unsuccessful attempt at getting internal lift to feed binding is illustrated in figure 2.

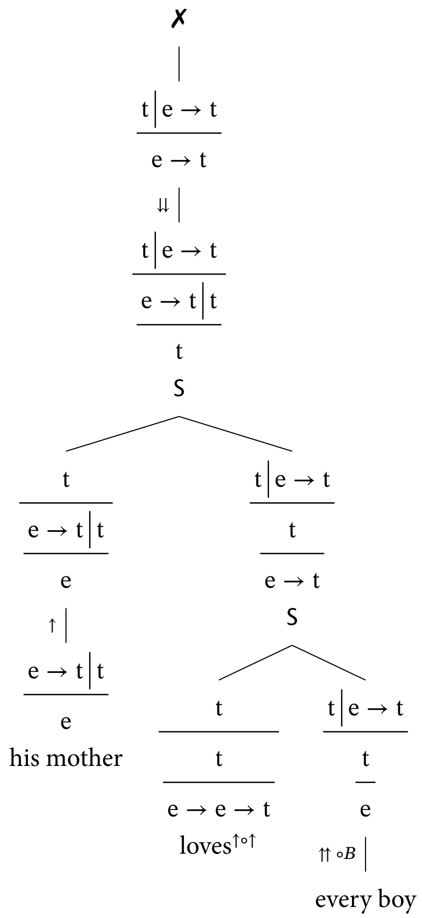

Figure 2: Unsuccessful binding (WCO)

What's crucial here is that both lower and internal lower are rigidly typed.

Just how satisfying is this as an explanation though? If we look at what lower actually *does*, there's no intrinsic reason why it should be so rigidly typed.

As shown in (5), all that lower does is feed its sole argument the identity function. On a maximally polymorphic definition, therefore, the argument need only be of type $(\mathsf{a} \to \mathsf{a}) \to \mathsf{b}$.

(5) Lower (maximally polymorphic ver.)
$m^{\downarrow} := m\ id$

A maximally polymorphic lower could save the WCO-violating derivation in figure 2.

Based on what lower *does*, there's no strong *semantic* motivation for making it rigidly typed. Therefore, despite the initial conceptual appeal of Barker & Shan's system, its success ultimately rests on what looks like a syntactic stipulation.

1.2 Chierchia: WCO as a reflex of the dynamics of anaphora

Chierchia (2020) develops a theory of WCO based on *dynamic semantics*.

Much like continuation semantics, Dynamic Semantics (DS) is a semantic theory with a "built-in" left-to-right bias.

2 Dynamic semantics

Add more references below

DS is one of the most empirically successful theories of anaphora (Heim 1982, Groenendijk & Stokhof 1991, Dekker 1994, a.o.) and presupposition projection (Heim 1983, Beaver 2001, a.o.). It has also been extended to a variety of other phenomena, including epistemic modality, exhaustification (Elliott 2019), and more.

Crowning achievements of DS include analyses of the following phenomena:[6]

- Presupposition projection.[7]

(6) a. [Ka visited Rome last summer]$^{\alpha}$,
and [she visited Rome again]$_{\alpha}$ this summer.
b. # [Ka visited Rome again]$_{\alpha}$,
and [she visited Rome last summer]$^{\alpha}$.

- Donkey anaphora.

(7) a. Every farmer who owns a donkey^{3} treasures it$_{3}$.
b. ? Every farmer who owns it$_{3}$ treasures a donkey^{3}.

- Cross-sentential anaphora.

(8) a. A man^{1} walked in. He$_{1}$ sat down.
b. * He$_{1}$ sat down. A man$_{1}$ walked in.

[6] The (b) examples are included to briefly show that the phenomena under consideration exhibit a *left-to-right asymmetry*, thus motivating a dynamic treatment.

[7] Approaches to dynamic semantics are split as to whether they collapse presupposition satisfaction and anaphora resolution (see, e.g., van der Sandt 1992) or not (Heim 1983).

The dynamic semantics ultimately adopted by Chierchia follows the latter tradition. This won't be so important for the purposes of this class, but will be relevant when we talk about presupposition, starting from next week!

Dwelling on cross-sentential anaphora, the contrast in (8) is clearly reminiscent of a wco effect.

As we'll see, orthodox dynamic semantics doesn't by itself explain wco, once quantificational scope is in the picture (see Charlow 2019 for discussion of this point), but Chierchia's basic intuition is to build a theory of wco based on this contrast.

In the next section, we'll introduce dynamic semantics by constructing an orthodox fragment that can account for cross-sentential anaphora. We'll move on to show how it fails to capture wco, before moving on to Chierchia's modification.

2.1 A Heimian fragment

Sentential meanings in ds (Heim 1982, Groenendijk & Stokhof 1991, Chierchia 1995), have two essential components:

- An input-output asymmetry – sentences denote *instructions* to change the input context (see especially Heim 1982).
- Indeterminacy – certain expressions may induce an *indeterminate* output.

To model this formally, many theories of ds model sentence meanings as *relations between assignments* (equivalently: functions from assignments, to sets of assignments).

dps introduce Discourse Referents (drs), modeled as variables; indefinites, unlike definites induce *indeterminacy*, concerning the identity of the dr. This is illustrated schematically in figure 3.[8]

[8] One way of thinking about this: definites induce a *functional* relation between assignments – every input assignment is mapped to a unique output assignment, whereas indefinites induce a *non-functional* relation between assignments – each input assignment can mapped to one or more output assignments.

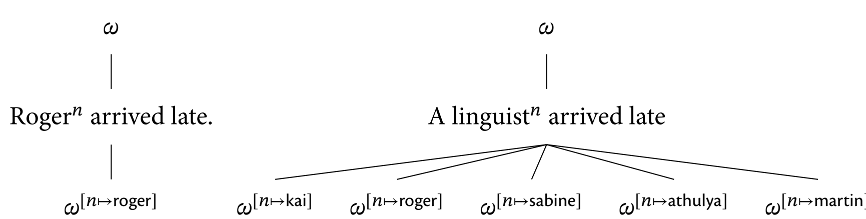

Figure 3: Relations between assignments

Assignments are functions from variables to individuals; as is standard, we'll represent the set of variables as $\mathbb{N}$:[9]

[9] We'll use o as the type of assignments to distinguish between assignments used in a static setting.

(9) Type of assignments
$o := n \to e$

Chierchia assumes that assignments are *partial* functions.[10] That is to say, an assignment may only be defined for certain indices. The following are all valid assignments:

[10] See also Rothschild & Mandelkern (2017) for a DS using partial assignments.

$$[1 \mapsto \text{roger}] \qquad \begin{bmatrix} 1 \mapsto \text{roger} \\ 3 \mapsto \text{martin} \end{bmatrix} \qquad \begin{bmatrix} 4 \mapsto \text{kai} \\ 5 \mapsto \text{athulya} \\ 7 \mapsto \text{sabine} \end{bmatrix}$$

In order to characterize a dynamic sentential meaning, we define a type constructor T to abbreviate relations between assignments:

(10) Type of Context Change Potentials (CCPs)
$T := o \to o \to t$

Add some example sentential meanings here

We can get back an "ordinary" sentential meaning from a CCP by existentially closing the output assignment, as defined in (11).

(11) Dynamic closure (def.)
$m^{\downarrow} := \lambda\omega\,.\,\exists\omega'[m\;\omega\;\omega']$ $\qquad \downarrow : T \to t$

How do we build up CCPs compositionally? Chierchia assumes that predicates are fundamentally Montagovian (i.e., functions of type $e \to t$):

(12) $[\![\text{swim}]\!] := \lambda x\,.\,\text{swim}\;x$ $\qquad e \to t$

Predicates are lifted into a dynamic setting by a type-shifter *dynamic lift*; d-lift takes a function from an individual to a truth-value, and shifts it into a function from an individual to a CCP – specifically, a dynamic *test*.[11]

[11] A different way of generalizing this to n−place predicates is by giving Δ the following definition:

(13) $m^{\Delta} := \lambda k\,.\,\lambda\omega\omega'\,.\,\omega = \omega' \wedge m\;k$
$\Delta : ((a \to t) \to t) \to (a \to t) \to t$

Chierchia's d-lift can be derived as follows, using the (by now very familiar) continuation semantics operations:

(14) $\lambda x\,.(x^{\uparrow}\;S\;f^{\Delta\circ\uparrow})^{\downarrow}$

(15) Dynamic lift (def.)
$f^{\Delta} := \lambda x\,.\,\lambda\omega\,.\,\lambda\omega'\,.\,\omega = \omega' \wedge f\;x$ $\qquad \Delta : (e \to t) \to e \to T$

> **Exercise**
>
> Chierchia defines dynamic lift in such a way that it only can apply to one-place predicates. This is not insignificant – see the discussion of event semantics later on. It is however trivial to generalize to d-lift to n-place predicates.
> Generalize *dynamic lift* to n-place predicates by giving a recursive definition a la Partee & Rooth 1983.

Tests don't do anything interesting to input contexts. In orthodox dynamic fragments, all of the interesting dynamic action is triggered by arguments – specifically, pronouns and indefinites.

A pronoun indexed n expects a dynamic predicate k as its input, and returns a CCP – a function from an input assignment ω to the result of feeding ω_n into k, *re*-saturated with ω.[12]

(19) Pronouns (def.)
$\mathsf{pro}_n := \lambda k\,.\,\lambda\omega\,.\,k\;\omega_n\;\omega$[13] $\qquad\mathsf{pro}_n : (\mathsf{e} \to \mathsf{T}) \to \mathsf{T}$

Pronouns now may compose with d-lifted predicates via Function Application (FA), as illustrated in figure 4:

$\boxed{\lambda\omega\omega'\,.\,\omega = \omega' \wedge \mathsf{swim}\;\omega_3}$

$\lambda k\,.\,\lambda\omega\,.\,k\;\omega_3\;\omega \qquad \lambda x\,.\,\lambda\omega\omega'\,.\,\omega = \omega' \wedge \mathsf{swim}\;x$

he$_n$ $\qquad\qquad$ Δ

swim

Figure 4: Pronouns in a dynamic fragment. "He$_3$ swims"

The result is a dynamic *test*, that saturates the argument of *swim* with whatever the input assignment ω maps to pronominal index 3 to.

In an orthodox dynamic fragment (Heim 1982, Groenendijk & Stokhof 1991), indefinites introduce DRS.[14,15]

(20) Indefinites (Heimian def.)
$\mathsf{someone}_n := \lambda k\,.\,\lambda\omega\omega'\,.\,\exists x, w''[\omega \overset{n/x}{=} \omega'' \wedge k\;x\;\omega''\omega']$
$\mathsf{someone}_n\;(\mathsf{e} \to \mathsf{T}) \to \mathsf{T}$

In figure 5, we show how a Heimian indefinite composes in a dynamic fragment. The result maps each input assignment ω to (the characteristic function of) a *set* of assignments ω', s.t., ω'_n is a swimmer.

[12] The type signature of a pronoun betrays the fact that, in this dynamic grammar, pronouns are *scope-takers*, and in fact, we can abbreviate a pronominal meaning using tower notation:

(16) Pronouns (tower def.)
$$\mathsf{pro}_n := \frac{\lambda\omega\,.\,([]\;\omega)}{\omega_n}$$

Interestingly, this is what we get if we apply the *bind* of the `Reader` monad to the static entry for a pronoun.

(17) Pronoun (static def.)
$\mathsf{pro}_n := \lambda\omega\,.\,\omega_n$
$\mathsf{o} \to \mathsf{e}$

(18) Bind of `Reader` (def.)
$m^\star := \lambda k\,.\,\lambda\omega\,.\,k\;(m\;\omega)\;\omega$
$(\mathsf{o} \to \mathsf{a}) \to (\mathsf{a} \to \mathsf{o} \to \mathsf{b}) \to \mathsf{o} \to \mathsf{b}$

[13] Chierchia actually posits a syncategorematic rule for composing pronouns and dynamic predicates – instead, I've built what Chierchia's rule does into the meaning of the pronoun.

[14] Chierchia will ultimately reject this assumption, but it will be useful to consider his claims in light of the standard theory.

[15] $\omega \overset{n/x}{=} \omega'$ is defined iff ω_n is *un*defined, and is true just in case ω' differs from ω at most in what n is mapped to.

Heim's *novelty condition* is essentially built into the rule for DR introduction.

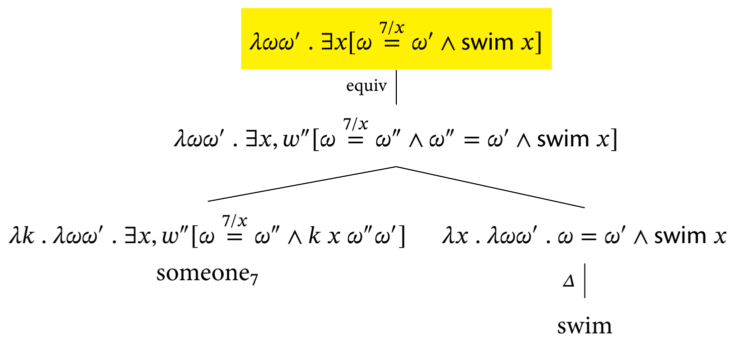

Figure 5: Heimian indefinites in a dynamic fragment
"Someone$_7$ swims"

A famous design feature of DS is an account of cross-sentential binding, as in the following famous examples:

(21) a. Someone[1] walked in and he$_1$ sat down.
b. Someone[1] walked in. he$_1$ sat down.

In DS, conjunction – as in (21a) – is treated as a special case of *discourse sequencing* (21b).

Discourse sequencing is an operation on CCPs:

(22) Dynamic sequencing (def.)
$m\,;n \coloneqq \lambda\omega \,.\, \lambda\omega' \,.\exists\omega''[m\ \omega\ \omega'' \wedge n\ \omega''\ \omega']$ $\qquad (;) : \mathsf{T} \to \mathsf{T} \to \mathsf{T}$

An illustration of how cross-sentential anaphora works in a Heimian fragment is given in figure 6: sequencing the CCPs gives rise to a CCP that relates ω and ω' just in case ω_4 is undefined and and ω'_4 walked in and sat down.

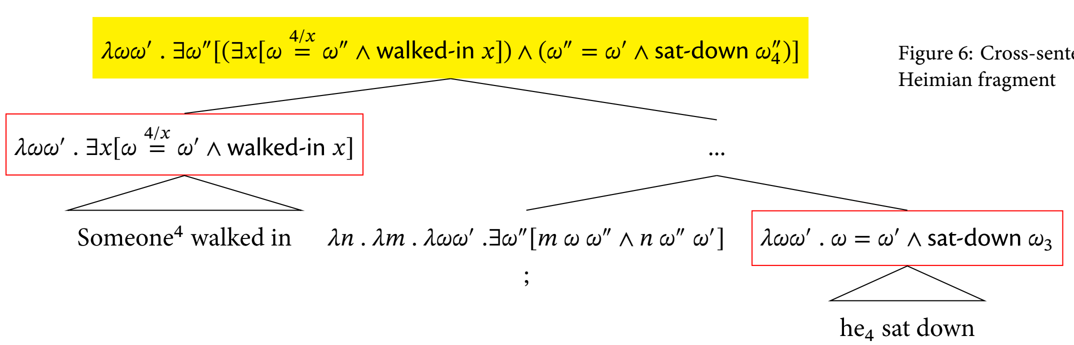

Figure 6: Cross-sentential anaphora in a Heimian fragment

Why is DS promising as a starting point for a theory of WCO? Recall the contrast below, reminiscent of WCO:

(23) a. Someone[4] walked in and he sat down.
b. *He$_4$ walked in and someone[4] sat down.

Just so long as *someone* takes scope within its containing sentence, DS captures this contrast, by virtue of the left-to-right bias built into the definition of discourse sequencing.

If we try to compute the CCP for (23b), the result is guaranteed to be undefined. This is because, if the input assignment ω is defined for 4, it can't also be *undefined* for 4, as is required by the meaning contributed by the indefinite.

(24) $\lambda\omega\omega' \,.\, \exists\omega''[\omega = \omega'' \wedge \textsf{sat-down}\ \omega_4 \wedge (\exists x[\omega'' \overset{4/x}{=} \omega' \wedge \textsf{walked-in}\ x])]$

DS doesn't by itself however capture WCO – this is because, independently, we need a mechanism that allows indefinites to *take scope*; indefinites introduce discourse referents at their scope site. We can therefore compute a bound reading for the following example, by scoping the indefinite over the pronoun:[16]

[16] For reasons that will become clear here, we're being a bit sneaky concerning how the scoped indefinite binds its trace.

- $\lambda\omega\omega' \,.\, \exists x[\omega \overset{4/x}{=} \omega' \wedge \omega_4'\ \textsf{want}\ (\omega_4\ \textsf{meet}\ x)]$
  - someone$_4$
  - $\lambda x \,.\, \lambda\omega\omega' \,.\, \omega = \omega' \wedge \omega_4\ \textsf{want}\ (\omega_4\ \textsf{meet}\ x)$
    - λx
    - $\lambda\omega\omega' \,.\, \omega = \omega' \wedge \omega_4\ \textsf{want}\ (\omega_4\ \textsf{meet}\ x)$
      - he$_4$
      - $\lambda y \,.\, \lambda\omega\omega' \,.\, \omega = \omega' \wedge y\ \textsf{want}\ (y\ \textsf{meet}\ x)$
        - Δ
          - $\lambda y \,.\, y$ wants to meet x

Figure 7: Violating WCO in a Heimian fragment
"He$_4$ wants to meet someone^4"

Intuitively, a problematic feature of DS in this regard is that it ties together DR introduction with quantificational scope.

2.2 *The Dynamic Prediction Principle*

At the heart of Chierchia account of WCO is an apparently minor modification to orthodox dynamics, with far reaching consequences: the Dynamic Predication Principle (DPP), stated in (25).

(25) The Dynamic Predication Principle (DPP)
DRs can only be introduced by predicates. (Chierchia 2020: p. 32)

Chierchia's innovation is to posit a second way of lifting predicates into a dynamic setting: DR-*lifting*.[17]

(26) DR-lift (def.)
$f^{\Delta_n} := \lambda x \,.\, \lambda\omega \,.\, \lambda\omega'\omega \overset{n/x}{=} \omega' \wedge f\ x$ $\qquad \Delta_n : (\mathtt{e} \to \mathtt{t}) \to \mathtt{e} \to \mathtt{T}$

[17] If you try to generalize DR-lift to n-place predicates, you'll find that it can't be done in quite the same way as for d-lift. As an exercise, try to figure out why this.

Introducing DRs then, is no longer the job of *indefinites*, but rather the job of a DR-lifted predicate.

What do indefinites do then? For Chierchia, they're just type-lifted first-order quantifiers.[18]

(27) Dynamic existential quantification (def.)
$\mathsf{someone}_n\ m := \lambda\omega\omega' \,.\, \exists x_n[m\ \omega\ \omega']$ $\qquad \mathsf{someone}_n : \mathtt{T} \to \mathtt{T}$

[18] Looking at the definition in (27), you may be wondering how *someone* binds its trace. Chierchia does something rather sneaky here, which will be important later. For now, assume that it just works.

Someone saturates the argument that a DR was introduced relative to, and cross-sentential anaphora proceeds as usual.

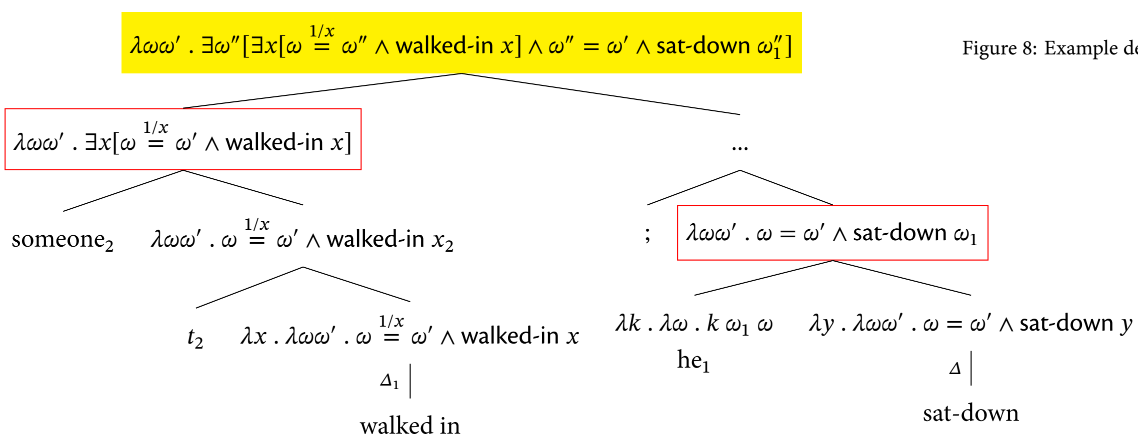

Figure 8: Example derivation

So far, we've constructed a system which replicates the basic results of orthodox dynamic semantics, but with a different compositional regime.

2.3 Accessibility

In the previous section, we only gave definitions for *dynamic conjunction/discourse sequencing* and the static first order existential.

Chierchia adopts the standard dynamic definitions for the other logical operators.

Negation is taken to be *externally static*; any DRS introduced in the scope of negation are subsequently wiped out.

(28) Dynamic negation (def.)
$\neg\, m \coloneqq \lambda\omega\,.\,\lambda\omega'\,.\,\omega = \omega' \land \neg\,(m^{\downarrow}\,\omega)$ $\qquad \neg : \mathsf{T} \to \mathsf{T}$

Externally static negation predicts the impossibility of binding in the following:

(29) *It's not the case that anyone[1] walked in. He$_1$ sat down.

To see why, first consider the prejacent of negation, with DR-lift applied to the predicate:[19]

(30) $[\![\text{anyone walked in}]\!] = \lambda\omega\omega'\,.\,\exists x[\omega \overset{1/x}{=} \omega' \land \textsf{walked-in}\ x]$

Applying dynamic negation to the above CCP *existentially closes* the output assignment, thereby rendering it dynamically inert. The resulting CCP is a dynamic test, and asserts that there is no way of extending the input assignment s.t. 1 is mapped to someone who walked in (in other words, nobody walked in).

(31) $\neg\,(30) = \lambda\omega\omega'\,.\,\omega = \omega' \land \neg\,\exists\omega'', x[\omega \overset{1/x}{=} \omega'' \land \textsf{walked-in}\ x]$

Sequencing this CCP with the second conjunct will clearly not give rise to anaphora.

The remainder of the logical operations can be defined via first-order equivalent via dynamic conjunction, negation, and existential quantification. All are defined as operations on CCPs.

(32) Dynamic implication (def.)
$m \to n \coloneqq \neg\,(m\ ;\ \neg\, n)$ $\qquad (\to) : \mathsf{T} \to \mathsf{T} \to \mathsf{T}$

(33) Dynamic disjunction (def.)
$m \lor n \coloneqq \neg\,(\neg\, m\ ;\ \neg\, n)$ $\qquad (\lor) : \mathsf{T} \to \mathsf{T} \to \mathsf{T}$

(34) Dynamic universal quantifier (def.)
$\textsf{everyone}_n m \coloneqq \neg\,\exists x_n\,(\neg\, m)$ $\qquad \mathsf{T} \to \mathsf{T}$

[19] We simplify here and assume that Negative Polarity Item (NPI) *any* is just an existential licensed in the scope of negation.

Famously, this way of dynamicizing the logical connectives gives rise to the following accessibility hierarchy in complex sentences:

(35) Accessibility (def.)
A is *accessible* to B if a DR active in A can covary with a pronoun in B.

Accessibility in conjunctive sentences: $[\text{A and B}]_S$

- A is accessible to B (but not vice versa).
- B is accessible to whatever is conjoined with S.

(36) A man^1 walked in, and he$_1$ sat down. He$_1$ stood up again soon after.

Accessibility in conditional sentences: $[\text{if A then B}]_S$

- A is accessible to B (but not vice versa).
- A, B are *not* accessible to what is conjoined with S.[20]

[20] In dynamic semantics, conditional sentences are internally dynamic, but externally static.

(37) #If someone^1 won the lottery, they$_1$ became rich. I shook their$_1$ hand.

Accessibility in negative sentences: $[\text{not A}]_S$

- Nothing in A is accessible to what is conjoined with S.

(38) *It's not the case that anyone^1 sat down. He$_1$ walked in.

Accessibility in disjunctive sentences: $[\text{A or B}]_S$

- A is not accessible to B, nor is B to A.
- Neither A not B is accessible to what is conjoined with S.[21]

[21] Dynamic disjunction is both internally static and externally static.

(39) #Either Mary has a new dog^1, or I petted it$_1$.

2.4 Enter events

So far, we've constructed a fragment that only accommodates one-place predicates. This is actually by design – Chierchia argues that such a system has a natural bed-fellow in neo-Davisonian event semantics.

Traditions in event semantics:

Davidsonian:

(40) $[\![\text{love}]\!] := \lambda exy \,.\, \mathsf{exp}\; e = y \wedge \mathsf{th}\; e = x \wedge \mathsf{love}\; e$ $\qquad \mathtt{v \to e \to e \to t}$

Neo-Davidsonian (Castañeda 1967, Parsons 1990):

(41) $[\![\text{love}]\!] := \lambda e \,.\, \mathsf{love}\; e$ $\qquad \mathtt{v \to t}$

According to the neo-Davidsonian approach, all arguments are severed, and instead introduced by thematic role heads (the compositional regime adopted here is after Champollion 2015):[22]

[22] See, e.g. Ahn 2016 and Elliott 2017 for independent evidence for this position from different domains.

(42) $\mathsf{THEME} := \lambda x \,.\, \lambda e \,.\, \mathsf{th}\; e = x$ $\qquad \mathtt{e \to v \to t}$

Abstracting away from dynamics for a moment, the composition of a simple sentence in a neo-Davidsonian setting can proceed via Predicate Modification (PM):

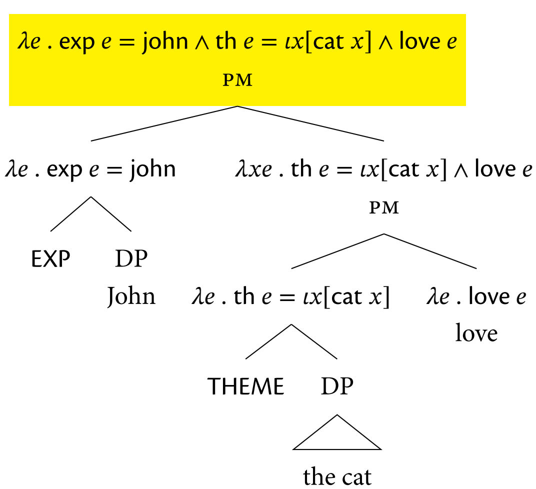

Figure 9: composition in a neo-Davidsonian event semantics

Note that, since verbs denote one place predicates, they can be DR-lifted.

Since the event argument of a verb is (by stipulation) existentially closed, this accounts for the possibility of eventive DRS, as in the following example:

(43) It rained^4. It$_4$ was heavy.

We can assume the following Logical Form (LF):

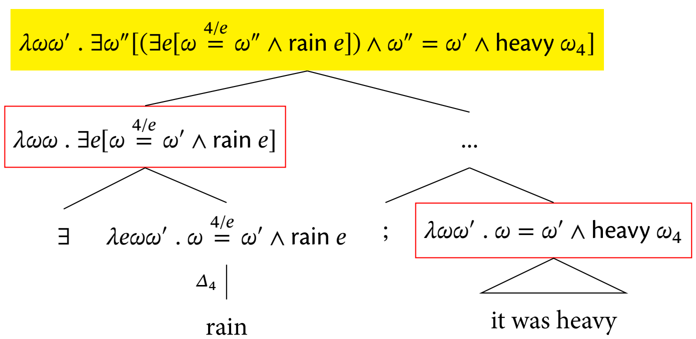

Figure 10: Eventive DRS

The discussion in the paper is quite confusing at this point, but Chierchia seems to assume that DR-lift extends straightforwardly to thematic argument-introducing heads. This is in fact not the case – we have to generalize DR-lift to predicates of type $e \to v \to t$.[23]

[23] As far as I can see, the compositional details of the system as laid out by Chierchia at this point are incoherent, but easily fixed.

(44) Thematic DR-lift (def.)
$f^{\Delta_n} := \lambda x . \lambda e . \lambda\omega\omega' . \omega \overset{n/x}{=} \omega' \wedge f\ x\ e \qquad \Delta_n : (e \to v \to t) \to e \to v \to T$

We furthermore must assume that *dynamic* PM is a freely available semantic composition rule.

(45) Dynamic PM (def.): $\left[\!\!\left[\ [\, m_{a\to T} \quad n_{a\to T} \,] \ \right]\!\!\right] := \lambda x_a . m\ x\ ;\ n\ x$

If we return to our simple example, we can now apply DR-lift every step of the way, as in figure 11:

What this essentially buys us is a sentence-internal accessibility hierarchy – the subject and object are accessible to the verb, but not nice versa, and the subject is accessible to the object, but not vice versa.

This can be leveraged in order to account for the basic cases of WCO:

Show exactly how this works:w

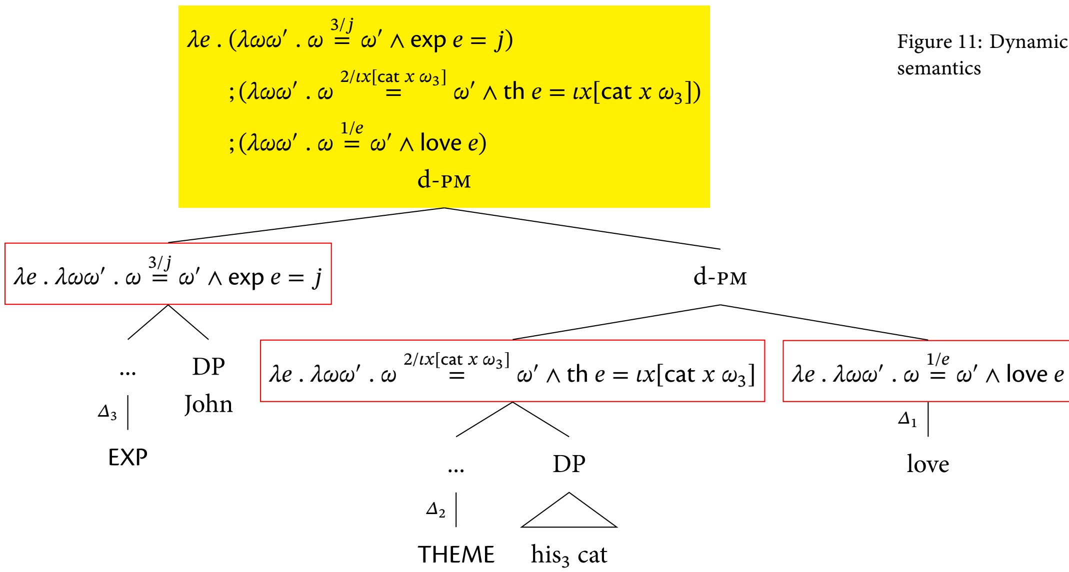

Figure 11: Dynamic neo-Davidsonian event semantics

2.5 *Binding into adjuncts*

2.6 *Bare plurals*

Finish this section

3 *Problems*

3.1 *The problem of existentials*

4 *Rethinking the system*

Conceptual issues:

- Much like, e.g., Dynamic Montague Grammar (DMG), Chierchia's system implicitly makes a syntactic distinction between two different kinds of variables.[24] Can we do better? Continuations provide a way of doing scope-taking without any need for traces, so this issue should (hopefully) dissolve if we shift to a continuation-based theory.

[24] See Barker & Shan's (2008) criticism of DMG for related discussion.

4.1 A more general dynamic system

Charlow (2019) (see also Charlow 2014) generalizes orthodox dynamic semantics. We'll adopt his system here.

Dynamic as are functions from an input assignment g, to a set of as paired with output assignments g'.

(46) $\mathsf{D\ a} \coloneqq g \rightarrow \{(a, g)\}$

(47) Unit (def.)
$a^{\eta} \coloneqq \lambda g\,.\,\{(a, g)\}$

Redo definition of bind

(48) Bind (def.)
$m^{\star} \coloneqq \lambda k\,.\,\lambda g\,.\bigcup_{(x,h)\in m\,g}\{k\ x\ h\}$ $\quad\star : \mathsf{D\ a \rightarrow (a \rightarrow D\ b) \rightarrow D\ b}$

(49) $\mathsf{pro}_n \coloneqq \lambda g\,.\,\{(g_n, g)\}$ $\quad\mathsf{D\ e}$

(50) $\mathsf{some\ boy}_n \coloneqq \lambda g\,.\,\{(x, g) \mid \mathsf{boy}\ x\}$ $\quad\mathsf{D\ e}$

(51) $m^{\Delta_n} \coloneqq \lambda g\,.\bigcup_{(x,h)\in m\,g}\{(x, h^{[n\rightarrow x]})\}$ $\quad\mathsf{D\ e \rightarrow D\ e}$

(52) $\mathsf{Q} \coloneqq \lambda k\,.\,\lambda g\,.\,\{(Q\ (\lambda x\,.\,(k\ x)^{\downarrow g})), g)\}$ $\quad\mathsf{everyone} : \dfrac{\mathsf{D\ t}}{\mathsf{e}}$

References

Ahn, Byron. 2016. Severing internal arguments from their predicates: an English case study. Handout from a talk given at the 2016 Annual Meeting of the Linguistics Society of America. Washington, DC.

Barker, Chris & Chung-chieh Shan. 2008. Donkey anaphora is in-scope binding. *Semantics and Pragmatics* 1.

Barker, Chris & Chung-chieh Shan. 2014. *Continuations and natural language* (Oxford studies in theoretical linguistics 53). Oxford University Press. 228 pp.

Beaver, David I. 2001. *Presupposition and assertion in dynamic semantics* (Studies in logic, language, and information). Stanford, California: CSLI. 314 pp.

Castañeda, Hector-Neri. 1967. Comments. In Nicholas Resher (ed.), *The logic of decision and action*, 104–112. Pittsburgh: University of Pittsburgh Press.

Champollion, Lucas. 2015. The interaction of compositional semantics and event semantics. *Linguistics and Philosophy* 38(1). 31–66.

Charlow, Simon. 2014. *On the semantics of exceptional scope*. Dissertation.

Charlow, Simon. 2019. Static and dynamic exceptional scope. lingbuzz/004650. accepted at *Journal of Semantics*.

Chierchia, Gennaro. 1995. *Dynamics of meaning: Anaphora, presupposition, and the theory of grammar*. Chicago: University of Chicago Press. 270 pp.

Chierchia, Gennaro. 2020. Origins of weak crossover: When dynamic semantics meets event semantics. *Natural Language Semantics* (28).

Dekker, Paul. 1994. Predicate logic with anaphora. *Semantics and Linguistic Theory* 4(0). 79–95.

Elliott, Patrick D. 2017. *Elements of clausal embedding*. University College London dissertation.

Elliott, Patrick D. 2019. Two souls of disjunction. unpublished manuscript.

Groenendijk, Jeroen & Martin Stokhof. 1991. Dynamic predicate logic. *Linguistics and Philosophy* 14(1). 39–100.

Heim, Irene. 1982. *The semantics of definite and indefinite noun phrases*. 2011 edition - typesetting by Anders J. Schoubye and Ephraim Glick. University of Massachusetts - Amherst dissertation.

Heim, Irene. 1983. On the projection problem for presuppositions. In *Proceedings of WCCFL 2*, 114–125. Stanford University.

Parsons, Terence. 1990. *Events in the semantics of English: a study in subatomic semantics*. The MIT Press.

Partee, Barbara & Mats Rooth. 1983. Generalized conjunction and type ambiguity. In *Meaning, use, and interpretation of language*, Reprint 2012, 361–383. Berlin, Boston: De Gruyter.

Rothschild, Daniel & Matthew Mandelkern. 2017. Dynamic semantics and pragmatic alternatives. Lecture notes from a course taught at ESSLLI 2017.

van der Sandt, Rob A. 1992. Presupposition projection as anaphora resolution. *Journal of Semantics* 9(4).

Shan, Chung-Chieh & Chris Barker. 2006. Explaining Crossover and Superiority as Left-to-right Evaluation. *Linguistics & Philosophy* 29(1). 91–134.