CROSSOVER $\stackrel{?}{=}$ DYNAMICS × EVENTS[1]

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[1] Thanks to Keny Chatain, Gennaro Chierchia, and Omer Preminger for useful discussion, as well as participants of 24.979.

Download me:
https://keybase.pub/patrl/handouts/lfrg-crossover.pdf

1 *The mystery of Weak Crossover (WCO)*

An endless fascinating fact about pronouns in natural language: they can be interpreted as *bound variables*:

(1) Who^x who aggravates his$_x$ mother?
LF: who (λx . x aggravates x's mother)

As famously observed by Postal (1971), bound variable interpretations are subject to apparently arbitrary structural restrictions:

(2) * Who^x does his$_x$ mother aggravate who?
LF: who (λx . x's mother aggravates x)

There's nothing deviant about the Logical Form (LF) in (2) – we can paraphrase the intended meaning as: *Who is such that his own mother aggravates him?*. The following should be a totally felicitous question-answer pair:[2]

(4) a. Who^x does his$_x$ mother aggravate?
b. # Tony Soprano^x's mother aggravates him$_x$.

Chomsky (1976) extended Postal's observations to constraints on bound variable interpretations with Quantificational Phrases (QPs).[3]

(5) Everyone^x aggravates his$_x$ mother?
LF: everyone (λx . x aggravates x's mother)

(6) * his$_x$ mother aggravates everyone^x?
LF: Everyone (λx . x's mother aggravates x)

To paraphrase Safir (2017: p. 1):

[2] As hinted at by the paraphrase, *own*-modification seems to ameliorate WCO effects. As far as I'm aware, there isn't any good explanation on the market for the ameliorating effect of *own*-modification, and this won't be something we'll be able to address in the confines of this presentation.

(3) ? Who^x does his$_x$ own mother aggravate?

[3] The facts are completely parallel, modulo the phonological reflex of displacement, if we adopt a movement-based theory of scope-taking (May 1977, Heim & Kratzer 1998), as emphasized by Chierchia (2020) however, (6) is mysterious for *any* theory in which scope can feed binding.

Weak Crossover (WCO) is a syntactic configuration in which pronouns cannot be co-construed with (i.e., bound by) certain kinds of displaced or quantified antecedents.

- Blocking of this co-construal does not seem logically required.
- The effect is syntactically conditioned.
- The effect is widespread in the world's languages.
- The effect does not appear to arise from instruction.

it is reasonable to assume that the WCO effect is a peculiar consequence of the human language capacity and a clue to the structure of that capacity.

A tempting response: certain kinds of displacement can't feed pronominal binding; concomitantly traces/copies bind pronouns.

(7) a. ✓Who^x t_x aggravates his$_x$ mother?
b. ✗Who^x does his$_x$ mother aggravate t_x?

As shown by many authors, such as Ruys (2000), this ain't gonna work – scope *can* feed binding.[4]

A paradigmatic case – *binding out of* DP:

(8) a. [Every boy^x 's mother] loves him$_x$.
b. [[Every boy^x 's mother]'s therapist] loves him$_x$.

(9) a. [Which boy^x 's mother] loves him$_x$?
b. [[Which boy^x 's mother]'s therapist] loves him$_x$?

See also – *inverse linking*.[5]

(10) [A friend of every capo^x] owes him$_x$ money. ✓∀ > ∃; ✗∃ > ∀

Another paradigmatic case – *binding into adjuncts* – a focus of Chierchia's paper.[6]

(12) Some cop interviewed every capo^x

[4] In other words, a bound variable interpretation doesn't require surface c-command. See also Barker 2012 for extensive argumentation along these lines.

[5] Note that the bound variable interpretation is only available if the universal takes wide scope – this is compelling evidence that what is feeding binding here is really *scope*.

[6] A standard solution to this problem is to posit cascading/Larsonian shell structures for right-adjoined constituents, but this contradicts evidence for principle C effects.

(11) The lawyer interviewed him [in the presence of Tony's lawyer].

Similar paradoxes are documented extensively by Pesetsky (1995). As we'll see later, we can resolve this particular paradox by adopting a theory of binding which doesn't require surface c-command.

[in the presence of his$_x$ lawyer].

$\exists > \forall; \forall > \exists$

(13) Which capo^x did some copy interview
[in the presence of his$_x$ lawyer]

A generalization that fits the facts as I've presented them: *scope can feed binding of a pronoun, just in case the base position of the scope-taker is to the* ***left*** *of the pronoun.*[7]

[7] Positing a linear component to the WCO generalization goes back to Chomsky's leftness condition.

As emphasized by Safir, *leftness* must be understood relative to some abstract level of representation:

(14) [Only in the presence of his$_x$ therapist] is each capo^x truly vulnerable.

Why should it be that the interaction between displacement/scope and binding is subject to a leftness condition?

Finally, an important fact about WCO is that it is sensitive to the A/A'-distinction. We'll come back to this later. Whatever the level of representation is at which leftness is computed, it is sensitive to the final A-position which the binder occupies.

(15) Every capo^x seems to his$_x$ therapist
[every capo to be feeling depressed]

Chierchia's (2020) fundamental insight is that this can be tied to an interpretive component which, for independent reasons, has a built in left-to-right bias – Dynamic Semantics (DS).[8]

[8] A similar tactic is adopted by Shan & Barker (2006) (see also Barker & Shan 2014), who attempt to explain crossover on the basis of *continuation semantics*, an approach to scope-taking with a built-in left-to-right bias. We won't have time here to discuss and compare Shan & Barker's proposal, but you can find detailed discussion in my handouts from 24.979: https://github.com/patrl/getting-high-seminar

One of the goals of DS is to account for cross-sentential anaphora, which displays a left-to-right asymmetry:

(16) Some goon^x walked in and he$_x$ took a seat at the card table.

(17) # He$_x$ walked in and some goon^x took a seat at the card table.

Cross-sentential anaphora also, naturally, involving binding without c-command – dynamic semantics purports to *explain* the contrast between by (16) and (17) positing a semantic theory in which meaning composition is an asymmetric

process.

Chierchia's ultimate goal will be to take the dynamic story for cross-sentential binding and generalize it to *intrasentential binding*, by arguing for a theory according to which LFs are fundamentally conjunctive – *neo-Davidsonian event semantics*, but we'll come back to this later.

First, some details of the kind of dynamic semantics Chierchia assumes.

2 *A dynamic excursion*

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 plurality, modal subordination, implicature, etc. All have been argued to exhibit left-to-right asymmetries.

In other words, we hardly need an excuse to buy into a theory which takes DS as a fundamental building block – there is already extensive evidence for linear asymmetries in the compositional semantics. A sampler from presupposition projection:[9]

(18) Paul used to vape, and now he stopped vaping for good.

(19) #Paul stopped vaping for good, and he used to vape.

[9] What the examples here illustrate is that, in a sentence of the form "P and Q", if ⟦P⟧ entails the presupposition of ⟦Q⟧ then "P and Q" is presuppositionless, despite the tendency of presuppositions to project (Karttunen & Peters 1979) – in dynamic semantics, we say that the presupposition of *he stopped vaping* is "satisfied" by the first conjunct (Heim 1983).

2.1 *Heimian dynamics*

Chierchia adopts a version of dynamic semantics in the Heimian/Amsterdam tradition. According to these theories, sentential meanings have two essential components:

- INPUT-OUTPUT ASYMMETRY – sentences are *instructions* for (potentially) changing an input (see especially Heim 1982).
- INDETERMINACY – the effect of a sentence on an input can be indeterminate, i.e., it can lead to multiple potential outputs.

To model this formally, Chierchia takes sentence meanings to be relations between input and output assignments (*IO asymmetry*) – concomitantly, input assignments can be mapped to multiple output assignments (*indeterminacy*).[10]

We call such relations between assignments Context Change Potentials (CCPs), following Heim 1982.

Assignments represent contextual information about which indices are mapped to which individuals. A context including assignments which map an index n to different individuals represents *contextual uncertainty* about who n gets mapped to.

For example, the following set of assignments models a context in which we are certain who 1, 2 pick out, but uncertain about who 3 picks out.[11]

$$\left\{ \begin{bmatrix} 1 \mapsto \text{sabine} \\ 2 \mapsto \text{martin} \\ 3 \mapsto \text{kai} \end{bmatrix}, \begin{bmatrix} 1 \mapsto \text{sabine} \\ 2 \mapsto \text{martin} \\ 3 \mapsto \text{roger} \end{bmatrix}, \begin{bmatrix} 1 \mapsto \text{sabine} \\ 2 \mapsto \text{martin} \\ 3 \mapsto \text{sabine} \end{bmatrix} \right\}$$

In DS, indefinites are special, in that they may *induce indeterminacy*[12] – *a linguist*^{n} *arrived late*, maps assignments ω that are *un*defined at n, to each *modified* assignment, in which n is mapped to a linguist who arrived late.

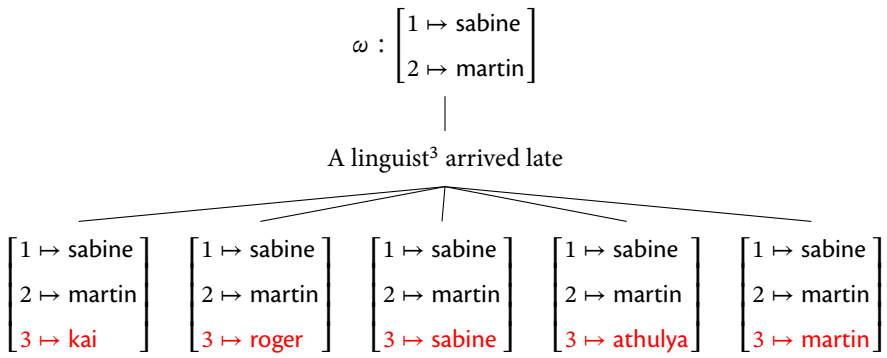

Figure 1: Indefinites induce uncertainty

In DS pronouns don't induce indeterminacy – *they*$_3$ *were wearing a hat* simply takes an input assignment, and returns it just in case ω_3 was indeed wearing a hat – in that sense, pronouns preserve prior indeterminacy, but can reduce contextual uncertainty. This is illustrated in figure (2).

In DS, we refer to indices as Discourse Referents (DRS) – by dint of the warp and weft of sentences inducing and reducing uncertaintly, pronouns co-refer with indefinites, despite not being within their scope.

You don't need to concern yourself too much with the details, but here are some

[10] Ultimately, we need to incorporate worlds – Heim (1982) treats Context Change Potentials (CCPs) as relations between assignment-world pairs. Since we'll be concentrating here exclusively on anaphora, this omission will be harmless.

[11] Note also that assignments here are taken to be *partial* – the domain of a given assignment is $N \subseteq \mathbb{N}$.

[12] In the dynamic parlance, this is called *random assignment*.

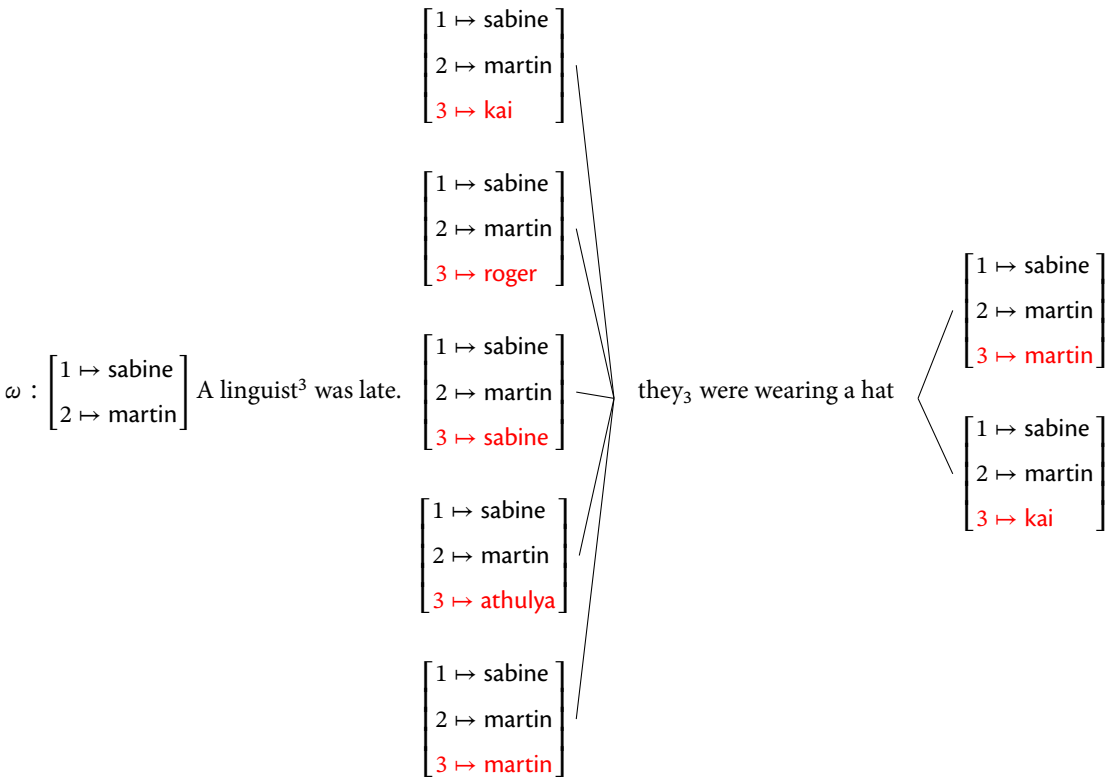

Figure 2: Pronouns reduce uncertainty

example sentence meanings in DS:[13]

(20) $[\![\text{A linguist}^3 \text{ arrived late}]\!] = \lambda\omega\omega' \,.\, \exists x[\omega \overset{1/x}{=} \omega' \wedge \text{linguist } x \wedge \text{arrived-late } x]$

(21) $[\![\text{They}_3 \text{ were wearing a hat}]\!] = \lambda\omega\omega' \,.\, \omega = \omega' \wedge \text{wearing-a-hat } \omega_3$

In order to account for cross-sentential anaphora, we write an entry for conjunction which feeds the output of the first conjunct in as the input to the second conjunct – this simply relates two assignments ω and ω', just in case feeding ω into the first conjunct gives an output that can be fed into the second conjunct, returning ω' – we already implicitly assumed something like this in figure (2).

(22) Dynamic sequencing/dynamic conjunction (def.)
$m\,;n \coloneqq \lambda\omega\omega' \,.\exists\omega''[m\ \omega\ \omega'' \wedge n\ \omega''\ \omega']$

The following is ruled out, because a sentence with an indefinite indexed n presupposes that n is undefined in the input assignment – interpreting the first conjunct will however inevitably result in assignments at which n is defined.

[13] $\omega \overset{n/x'}{\omega}$ is defined if ω_n is undefined (this encodes Heim's *novelty condition*), and is true if ω' differs minimally from ω, in that $\omega'_n = x$.

(23) * They$_3$ were wearing a hat, and a linguist^3 was late.

What we've said so far can account for the linear asymmetry we've observed in cross-sentential anaphora[14], but it falls short of getting us anywhere near a story for crossover. To get there, we need to say something concrete about how dynamics is integrated into sentence-internal composition.

[14] Modulo exceptional scope of the indefinite – see Charlow 2019 for discussion.

2.2 *The Dynamic Predication Principle (DPP)*

How do we build up the dynamic meaning for *A linguist was late*? One of Chierchia's departures from the orthodoxy, which will be crucial for the explanation of WCO, is the idea that *predicates* introduce DRS, not arguments; arguments are only associated with DRS indirectly.

He calls this the Dynamic Predication Principle (DPP) (this will need to be refined):

(24) The Dynamic Predication Principle (DPP) (first version)
DRS can only be introduced by predicates. (Chierchia 2020: p. 32)

At this point it will be helpful to be a little more concrete about some of the technical details. Alongside our ordinary types, $\mathtt{e}$, $\mathtt{t}$, etc., there's also a type of assignments $\mathtt{g}$.

As we've seen, in DS, sentences denote relationships between assignments of type $\langle \mathtt{g}, \langle \mathtt{g}, \mathtt{t} \rangle \rangle$ – in the dynamic parlance, these are called CCPS – we'll abbreviate this type as $\mathtt{T}$.[15]

[15] Our discourse sequencing operator ; is therefore of type $\langle \mathtt{T}, \langle \mathtt{T}, \mathtt{T} \rangle \rangle$.

(25) Context Change Potential (CCP) (def.)
$\mathtt{T} := \langle \mathtt{g}, \langle \mathtt{g}, \mathtt{t} \rangle \rangle$

Predicates of type $\langle e, t \rangle$ are lifted into functions from individuals to CCPS by a type-shifter d-lift, which I'll write as Δ.

(26) D-lift (def.)
$f^{\Delta} := \lambda x \,.\, \lambda\omega\omega' \,.\, \omega = \omega' \wedge f\ x$ $\qquad\qquad$ $\Delta : \langle\langle \mathtt{e}, \mathtt{t} \rangle, \langle \mathtt{e}, \mathtt{T} \rangle\rangle$

Applying d-lift to a predicate, and composing it with an individual gives back a *trivial* CCP, i.e., one which doesn't modify the input context. In the dynamic parlance, we call such a CCP a *test*.

(27) roger swims$^{\Delta} = \lambda\omega\omega' \,.\, \omega = \omega' \wedge \text{swims r}$

Pronouns can be treated simply as functions from assignments to individuals:

(28) Pronoun (def.)
$\text{pro}_n \coloneqq \lambda\omega \,.\, \omega_n$ $\langle g, e \rangle$

In order to compose a pronoun with a d-lifted predicate, we feed the input context into the pronoun, feed the result into the d-lifted predicate – we now have a way of compositionally constructing the CCP of a simple sentence involving a pronoun.[16]

(29) he_1 swims$^{\Delta} = \lambda\omega\omega' \,.\, \omega = \omega' \wedge \text{swims } \omega_1$

What does the job of introducing DRS, on this theory? Chierchia's innovation is to introduce a *second* way of lifting simple predicates into a dynamic setting – DR-lift.

DR-lift introduces a DR associated with the argument of the predicate.

(30) DR-lift (def.)
$f^{\Delta_n} \coloneqq \lambda x \,.\, \lambda\omega\omega' \,.\, \omega \overset{n/x}{=} \omega' \wedge f\ x$ $\Delta_n : \langle\langle e, t\rangle, \langle e, T\rangle\rangle$

This means that arguments can now introduce DRS *indirectly*, by composing with a DR-lifted predicate:

(31) roger swims$^{\Delta_3} = \lambda\omega\omega' \,.\, \omega \overset{3/r}{=} \omega' \wedge \text{swims r}$

The result is a CCP which returns a modified assignment, where 3 gets mapped to Roger. This DR can be picked up by a pronoun in a subsequent sentence, via the logic of dynamic conjunction.

(32) ✓(roger swims$^{\Delta_3}$) ; (he_3 likes front-crawl)

The following won't work(!):

(33) ✗(he_3 likes front-crawl) ; (roger swims$^{\Delta_3}$)

Finally, we need to say something about indefinites. How do they come to

[16] Here, I gloss over exactly how we go about achieving this result – there are a couple of different possibilities. Chierchia posits a syncategorematic rule to compose pronouns and predicates, which does essentially what I describe here in prose. Alternatively, we could define the pronoun as something that takes scope over over a CCP, as in Elliott 2020.

induce indeterminacy? In Chierchia's system indefinites denote first-order quantifiers, lifted into a dynamic setting.

They have no power to introduce DR by themselves, but so *indirectly*, if their trace (a first order variable) composes with a DR-shifted predicate.[17]

[17] In order to distinguish first-order variables relevant for quantificational binding in the metalanguage, I'll write them with a subscript index x_n.

(34) Dynamic existential quantification (def.)
$\text{someone}_n\ m \coloneqq \lambda\omega\omega' .\ \exists x_n[m\ \omega\ \omega']$ $\qquad\qquad$ $\text{someone}_n : \langle \mathsf{T}, \mathsf{T}\rangle$

Composing *somone* with a DR-lifted predicate results in a CCP that induces indeterminacy - the indeterminate DR arises due to the combination of DR-lift and existential quantification:

(35) $\text{someone}_1\ (x_1\ \text{swims}^{\Delta_3}) = \lambda\omega\omega' .\ \exists x_1[\omega \stackrel{3/x_1}{=} \omega' \wedge \text{swims}\ x_1]$

Likewise, a subsequent, co-indexed pronoun can co-vary with the quantifier, by the logic of discourse sequencing.

(36) ✓ $(\text{someone}_1\ (x_1\ \text{swims}^{\Delta_3}))\ ;\ (\text{he}_3\ \text{likes front-crawl})$

Again, the following won't work:

(37) ✗ $(\text{he}_3\ \text{likes front-crawl})\ ;\ (\text{someone}_1\ (x_1\ \text{swims}^{\Delta_3}))$

N.b., that the pronoun must be co-indexed with the DR-lift operation for anaphora to obtain. Co-indexation with the quantifier is irrelevant, since, on Chierchia's system quantificational binding essentially uses a distinct stock of variables.

In sum, dynamic semantics essentially introduces a *pseudoscope* mechanism for binding – we can think of this as "dynamic effects". The dynamic effects associated with an indefinite may outscope its quantificational effects. Famously, dynamic semantics is a theory in which the following equivalence holds:

(38) $\boxed{\text{someone}_3\ (f^{\Delta_1}\ x_3)}\ ;\ \boxed{\text{g pro}_1} \equiv \text{someone}_3\ \boxed{(\text{f}^{\Delta_1}\ x_3)\ ;\ (g\ \text{pro}_1)}$

2.3 Accessibility

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

Dynamic semantics also builds in a way of *eliminating* the dynamic effects associated with a sentence.

Certain expressions, such as negation, eliminate any DRS introduced in their scope. We can think of negation as creating a "dynamic island".[18]

[18] See especially Honcoop (1998), who artfully constructs a unified account of weak island effects and intervention effects by exploiting the notion of accessibility in dynamic semantics.

How does it do so? First, we'll define a helpful notion – *dynamic closure*. This existentially closes the output assignment, returning an ordinary, "static" meaning.

(39) Dynamic closure (def.)
$m^{\downarrow} := \lambda\omega \,.\, \exists\omega'[m\ \omega\ \omega'] \qquad \downarrow : \langle \mathsf{T}, \langle \mathsf{g}, \mathsf{t}\rangle\rangle$

We can now define dynamic negation in terms of dynamic closure – the following definition ensures that negation wipes out any DRS introduced in its scope. Negative sentences will always return unmodified assignments. We call this definition of negation "externally static".

(40) Dynamic negation (def.)
$\neg\ m := \lambda\omega \,.\, \lambda\omega' \,.\, \omega = \omega' \wedge \neg\ (m^{\downarrow}\ \omega) \qquad \neg : \langle \mathsf{T}, \mathsf{T}\rangle$

Externally static negation predicts the impossibility of binding in the following:[19]

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

[19] You might wonder about what we predict for a sentence such as the following, where the indefinite takes wide scope over negation:

(41) It's not true that someone walked in. He sat down.

This will be important later.

Comparing dynamic conjunction (;) and dynamic negation, we can see that DS naturally gives rise to generalization concerning whether or not an antecedent is *accessible* to a pronoun.

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

- Accessibility in conjunctive sentences: [A and B]$_S$
  - A is accessible to B (but not vice versa).
  - B is accessible to whatever is conjoined with S.
- Accessibility in negative sentences: [not A]$_S$
  - Nothing in A is accessible to what is conjoined with S.

3 *From dynamic semantics to event semantics*

The special sauce of dynamic semantics is really *discourse sequencing* – the way that CCPs are sequenced ensures that anaphoric effects introduced in the first sentence are passed into the second, but not vice versa.

In order to make DS do some work in the intrasentential domain, we need a theory according to which composition is fundamentally conjunctive.

Thankfully, there is already a prominent option on the market – *neo-Davidsonian event semantics* (Castañeda 1967, Parsons 1990).

The central conjecture of neo-Davidsonianism is that predicates simply denote predicates ranging over eventualities.[20,21]

(44) $[\![\text{love}]\!] \coloneqq \lambda e \,.\, \text{love}\ e$ $\langle \mathtt{v}, \mathtt{t} \rangle$

What about the arguments of the predicate? Neo-Davisonian LFS link eventualities to their thematic partipants via thematic functions in the metalanguage.

(45) $[\![\text{Tony loves Carmela}]\!] = \exists e \begin{bmatrix} \text{EXP}\ e = \text{tony} \\ \wedge\ \text{THEME}\ e = \text{carmela} \\ \wedge\ \text{love}\ e \end{bmatrix}$

Putting arguments to one side for a moment, note that one immediate consequence of combining Chierchia's dynamics with neo-Davidsonianism is a straightforward account of event anaphora:

(46) It rained. It was heavy.

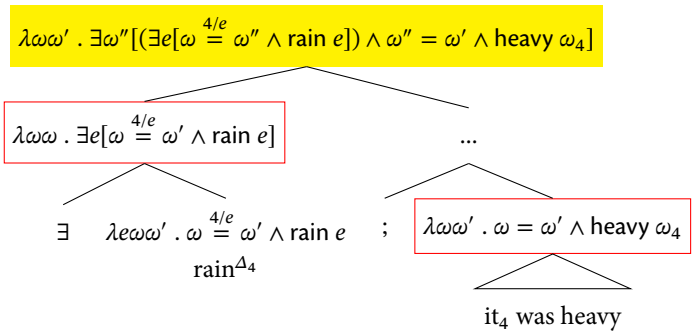

Figure 3: Eventive DRS

Chierchia adopts the compositional regime, roughly, of Champollion (2015), according to which thematic functions are represented in the syntax, and

[20] The type of events here is v.

[21] All compositional approaches to event semantics have in common the assumption that predicates take an event argument, which is existentially closed at some stage in the composition. There are at least two other approaches to incorporating events into the grammar – the *Davidsonian* approach, according to which predicates receive traditional Montagovian denotations, but *in addition* take an event argument, and the *Kratzerian* approach, according to which predicates compose with an event argument in addition to their internal argument – the external argument, on the other hand, is "severed" (see Kratzer 1996).

The neo-Davidsonian approach adopted by Chierchia is fairly radical in that *all* arguments, including internal arguments, are severed. For independent arguments for severing the internal arguments, see, e.g., Ahn 2015, 2016, Lohndal 2014, and Elliott 2017.

compose with DPs, returning event predicates.

(47) $[\![\text{[TH Carmela]}]\!] = \lambda e \,.\, \textsf{THEME}\ e = \textsf{carmela}$ $\langle \mathtt{v}, \mathtt{t} \rangle$

Chierchia (2020) assumes that, just like other predicates, thematic functions can be DR-lifted too.[22]

(48) $[\![\text{[TH}^{\Delta_3}\text{ Carmela]}]\!] = \lambda e \,.\, \lambda\omega\omega' \,.\, \omega \overset{3/c}{=} \omega' \wedge \textsf{THEME}\ e = \textsf{carmela}$ $\langle \mathtt{v}, \mathtt{T} \rangle$

[22] Technically speaking, this requires a different version of DR-lift – since Chierchia glosses over this, we will too.

We furthermore must assume that *dynamic* Predicate Modification (PM) is a freely available semantic composition rule – dynamic PM is just like ordinary PM, only instead of conjoining the inner propositional value, we do dynamic sequencing.

(49) Dynamic PM (def.): $\left[\!\!\left[\begin{array}{c} \wedge \\ m_{\langle \mathtt{a},\mathtt{T}\rangle} \quad n_{\langle \mathtt{a},\mathtt{T}\rangle} \end{array} \right]\!\!\right] := \lambda x_{\mathtt{a}} \,.\, m\ x\ ;\ n\ x$

Now, we have a system in which intrasentential binding can precede *indirectly*. This is illustrated below – since composition precedes via discourse sequencing, the output of the experiencer is fed in as the input of theme, and the output of the theme is fed in as the input of the verbal predicate.

(50) John^3 loves his$_3$ cat.

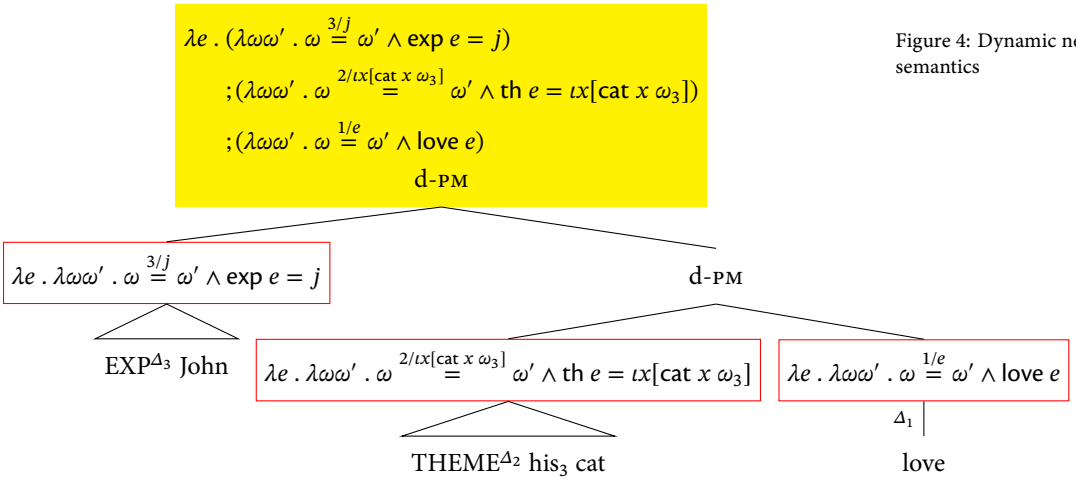

Figure 4: Dynamic neo-Davidsonian event semantics

This assumption gives us an *intrasentential accessibility hierarchy*. Since the *experiencer* precedes the *theme*, the experiencer is accessible to the theme

but not vice versa, and since the verb follows both, both preceding thematic arguments are accessible to the verb, and any subsequent conjuncts.

(51) EXP > THEME > *verb* > *adjuncts 1...n*

This can be leveraged in order to account for the basic cases of WCO. Successful Q-binding is illustrated in figure 5; the subject is accessible to the object, so the trace of the QP comes to dynamically bind the pronoun by DR-shifting the thematic role head.

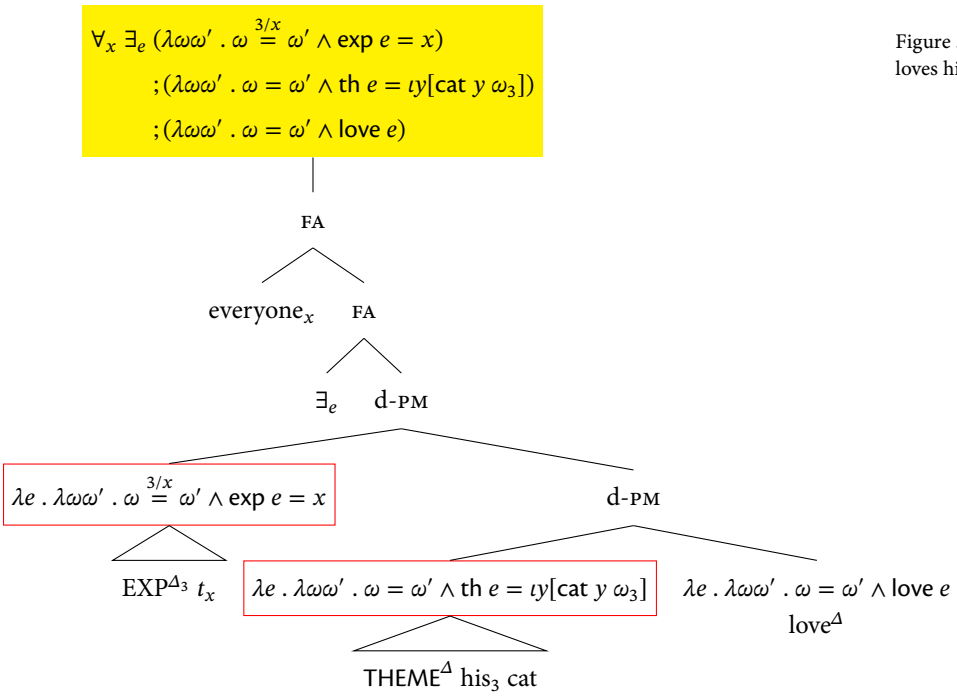

Figure 5: Successful Q-binding: "Everyone loves his cat".

Unsuccessful Q-binding is illustrated in figure 6 – since the object is *not* accessible to the subject, discourse binding of the pronoun by the trace of the QP fails.

Since composition is conjunctive, scope *can* feed binding, just in case the thematic function which introduces the DR associated with the QP trace is to the left of the pronoun.

(52) Everyone's mother loves them.

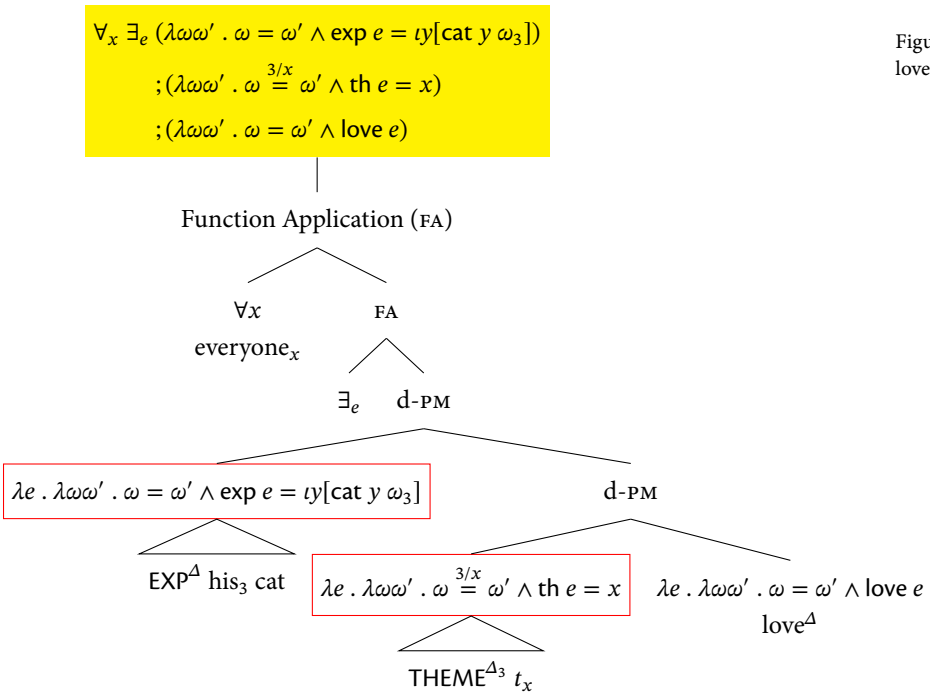

Figure 6: Unsuccessful Q-binding: *"His cat loves everyone".

(53) everyone$_x$ (EXP ((POSS$^{\Delta_3}$ x) mother)) (TH pro$_3$) (love)

3.1 Binding into adjuncts

Chierchia shows that, an advantage of incorporating events into the system, is that his theory straightforwardly accounts for binding into adjuncts[23]

In event semantics, adverbials are simply interpreted as properties of events, and are incorporated into the sentence via d-PM, below existential closure.

(54) $[\![\text{against John's will}]\!] = \lambda e\ .\ e$ against will j $\quad\langle \text{v}, \text{t}\rangle$

Since, the adverbial is a monadic predicate, it can of course be d-lifted:

(55) $[\![\text{against John's will}]\!]^{\Delta} = \lambda e\ .\ \lambda\omega\omega'\ .\ \omega = \omega' \wedge e$ against will j $\quad\langle \text{v}, \text{T}\rangle$

Since adverbials are adjoined to the right typically, the system predicts that *objects are accessible to right-adjoined adverbials*. We can now account for the following example straightforwardly:

(56) John loves everyone against their will.

[23] At least, adverbial adjuncts that are interpreted as event modifiers – see Parsons 1990.

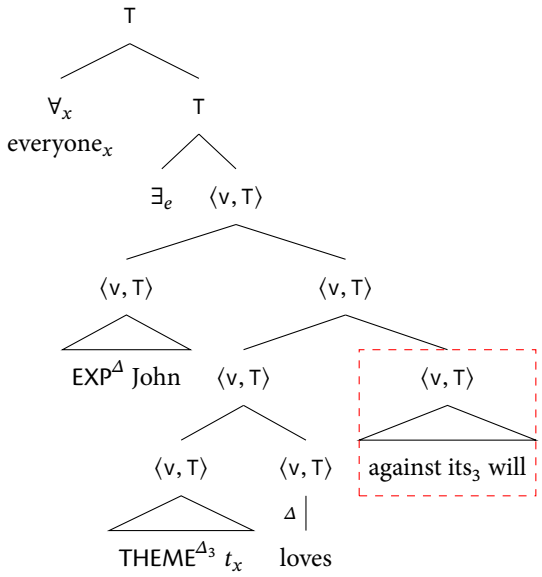

Figure 7: Binding into adjuncts

Since, in Chierchia's system is fundamentally conjunctive, and enforces a left-to-right bias, fronted predicates look like a problem.

(57) [With his therapist] each capo is vulnerable.

in order to account for the fact that fronted expressions can contain bound pronouns, Chierchia must invoke reconstruction of the dynamic predicate. This reduces left-adjoined adjuncts to the right adjoined cases.[24]

(58) [With his$_3$ therapist] $\lambda P_{\langle v,T\rangle}$ each capo is vulnerable t_P

[24] Privoznov, in progress, pursues an interestingly different explanation for the possibility of cataphora with adjuncts, also couched in dynamic semantics. In brief, Privoznov's account allows syntactic notions of spell-out to interact with the order in which constituents are sequenced in a dynamic sense – hopefully we'll be hearing more about this at a future LFRG!

4 *Problems*

4.1 *Two systems of binding*

The first issue with Chierchia's system is largely conceptual.

In the paper, it's assumed that the meta-language is something like first order logic – traces of quantifiers denote *first order* variables, and therefore as long as a trace is co-indexed with a quantifier, it is "magically" bound – traces of QPs are indirectly bound.

Chierchia therefore assumes a completely different system of indexation and binding specific to QPs. If we wanted to translate Chierchia's approach into

a theory in which binding is more direct, we'd need to redefine the CCP type constructor as follows:

(59) $\mathsf{T} := \langle \mathsf{g}, \langle \mathsf{g}, \langle \mathsf{g}, \mathsf{t} \rangle \rangle \rangle$

We'd also need to ensure, somehow, that quantifiers can't accidentally bind pronouns directly. This is essential.

The need to distinguish between first order variables and genuine pronouns has precedents in the dynamic literature[25], but this is arguably a conceptually unappealing aspect of the proposal.[26]

[25] Dekker 1994

[26] See Barker & Shan's criticism of Dynamic Montague Grammar (DMG) for relevant discussion.

Arguably, this assumption is an artifact of the fact that Chierchia adopts a Quantifier Raising (QR) theory of scope-taking, as well as the assumption that traces denote variables.

Both of these assumptions can be dispensed with in an in-situ theory of scope taking, such as *continuation semantics*,[27] extended to overt A'-displacement by Elliott 2019.

[27] Barker 2002,Barker & Shan 2014.

Marrying such a theory with Chierchia's dynamics would result in a theory of WCO in which we only have to worry about one stock of variables - those used for pronominal binding, although this requires a non-trivial amount of work.

4.2 A-movement

Paying attention only to simply sentences involving A'-movement, and quantifier scope, Chierchia's theory, although technically involved, looks rather neat.

Unfortunately, as acknowledged by Chierchia, A-movement bleeds WCO, thereby ruining this neat picture:

(60) Every boy^1_x seems to his$_1$ mother [t_x to be happy].

Furthermore, A-movement out of an externally static environment feeds dynamic binding:

(61) Someone didn't leave. He sat down.

On Chierchia's theory, there's only one way to account for this – the derived

predicate created by A-movement must be one that can DR-shifted.

(62) Someone (λx . x didn't leave)^{A_3}. He$_3$ sat down.

This leads to an unavoidable weakening of the DPP:

(63) The Dynamic Predication Principle (DPP) (refined ver.)
DRS can only be introduced by:
a. Derived positions created by A-movement
b. predicates.

Theoretically, this means that the operation of DR-lifting must be licensed at derived predicates created by A-movement. This doesn't seem particularly enlightening or explanatory.

Chierchia speculates that it's possible to associate the DR-introduction with T, but as is well known, in languages with A-scrambling, it bleeds WCO. This is illustrated below for German:

(64) *...*dass [seine$_x$ Schwester] [jeden Mann]^x verabscheut.*
...that [his sister.NOM] [every man.ACC] loathes.
"...that every man is s.t. his sister loathes him."

(65) *...dass [jeden Mann]^x [seine$_x$ Schwester] verabscheut.*
...that [every man.ACC] [his sister.NOM] loathes.
"...that every man is s.t. his sister loathes him."

This really means that derived predication induced by A-movement really must be different to derived predication induced by A'-movement, but no real explanation for this is proffered.

4.3 The problem of existentials

The A/A'-distinction is an area where Chierchia's theory doesn't help us much, but arguably existing accounts also involve uncomfortable stipulations.

A more deadly flaw for Chierchia's system is its treatment of existentials.

Since DR-introduction is performed by *predicates* rather than arguments, Chierchia makes a bad prediction: Scoping an indefinite out of an *externally static* environment should fail to feed binding.[28]

[28] It's not necessary to use a specific indefinite to illustrate this point, but it does make the wide-scope reading more salient.

This is clearly a bad prediction, as illustrated by (66)

(66) It's not the case that a certain boy^1 sat down. He$_1$ left hours ago.

To see *why* Chierchia makes this prediction, it's enough to consider the simple event-free fragment from the beginning.

First, consider the meaning of the prejacent of negation, with a DR-shifted predicate relative to 1. This introduces a DR corresponding to the trace of the quantifier.

(67) $[\![t_x \text{ sat down}]\!] = \lambda\omega\omega' \,.\, \omega \overset{1/x}{=} \omega' \wedge \textsf{sat-down}\ x$

Applying dynamic negation to the prejacent closes off the discourse referent:

(68) $\neg$ (67) $= \lambda\omega\omega' \,.\, \omega = \omega' \wedge \neg\, \exists\omega''[\omega \overset{1/x}{=} \omega'' \wedge \textsf{sat-down}\ x]$

Now, binding the trace with an existential quantifier fails to re-introduce the DR that was wiped out by dynamic negation.

(69) $\exists_x$ (68) $= \lambda\omega\omega' \,.\, \omega = \omega' \wedge \exists x[\neg\, \exists\omega''[\omega \overset{1/x}{=} \omega'' \wedge \textsf{sat-down}\ x]]$

Chierchia concludes that (a) we should treat indefinites as *choice-functional variables*, and furthermore than (b) existential closure of a choice-functional variable introduces a DR. This is clearly a weakening of the DPP.

(70) The Dynamic Predication Principle (DPP) (refined ver.)
DRs can only be introduced by:
a. A-positions
b. predicates.
c. existential closure of choice-functional variables.

The refined version of the theory predicts that *indefinite scope feeds DR-introduction*.

Note that this predicts that *wide-scope* indefinites should obviate WCO. Chierchia argues that this is a good prediction based on the following contrasts. As has been observed before, *specific indefinites can obviate WCO*.

(71) a. * His$_1$ father hates a boy^1.
b. ? His$_1$ father hates { a boy I know^1 | a certain boy^1 | a friend of mine^1 }

Unfortunately, this tying together of DR introduction and WCO obviation is going to lead to a fatal flaw in Chierchia's theory. Anything that can introduce a DR by scoping out of an externally static environment must introduce a DR at its *scope site*; anything that does so is predicted to obviate WCO.

wh-expressions can introduce DRS:

(72) Who^1 walked in? and, did they$_1$ sit down?

Furthermore, *wh*-moving out of an externally static environment feed DR introduction:

(73) Who^1_x does nobody like t_x? and, where are they$_1$?

Even wh-in-situ can scope out of an externally static environment, feeding DR introduction:

(74) Which boy^1_y t_y bought none of his friends which book^2 ?
and, why did he$_1$ hate it$_2$ so much?

By Chierchia's logic it follows that *wh*-expressions *must* introduce DRS at their scope site, and this predicts that *wh*-scope should obviate WCO. This loses an explanation for the original cases of WCO – *wh*-movement can certainly *not* obviate WCO.

(75) * Which boy^1_x does his$_1$ father hate t_x?

(76) * Which book^1_x did John give none of it$_1$ s fans t_x?

...back to the drawing board?

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