Scope, binding, and what's beyond the surface

1: Life without QR

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A metatheoretical observation

- No-one has a clue what Minimalists are on about.
- Not even other syntacticians, let alone other linguists, let alone other cognitive scientists.
- Standard complaint: "Whatever Minimalism is, it certainly isn't minimal".
- I agree.
- Two reasons why Minimalist syntax doesn't look minimal.
  1. Many Minimalist syntacticians are very good at their jobs. They discover facts and build them into their theories. This sometimes complicates their theories. In a good way.
  2. The goals of Minimalist syntax just aren't the same as those of other syntactic theories.

The Y-model

- Most theories of syntax (CCG, HPSG, Construction Grammar, parallel architecture, etc.) also include partial theories of semantics and phonology (at least word order). Those theories at least cover:
  - Where do semantic/phonological representations come from?
  - How do phonology/syntax/semantics talk to each other?
- Usual answer: the different representations are generated in parallel. No necessary feeding relation between syntax/semantics/phonology.
- This has never been Chomsky's answer.
- Since the early 1970s, and explicitly since Chomsky & Lasnik (1977), the Chomskyan claim has been that syntax feeds phonology and semantics; phonology and semantics do not communicate directly with each other.
- This is the Y-model.

LF and the Y-model

- This architectural difference means that "narrow Chomskyans" are aiming at different goalposts from everyone else.
- For researchers in other traditions, syntax is largely encapsulated from semantics, as the two representations are constructed in parallel. If semantic or phonological representations were somehow "prefigured" in syntactic representations, it would be a puzzling accident.
- For Chomskyans, the exact opposite would be true.

History of the Y-model, pt.1

1977

(6) 1. Base
2. Transformations (movement, adjunction, substitution)

3a. Deletion	3b. Construal
4a. Filters	4b. Quantifier interpretation, etc.
5a. Phonology	
6a. Stylistic rules	

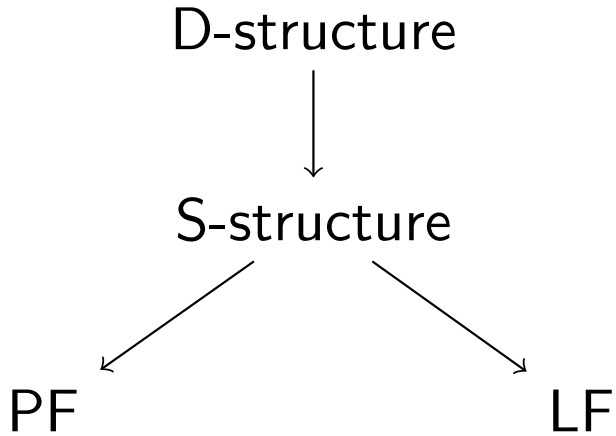
(Chomsky & Lasnik 1977: 431)

- Argumentation at this point largely based on ordering of operations, etc.
- Syntax–semantics and syntax–phonology interfaces still treated roughly equally

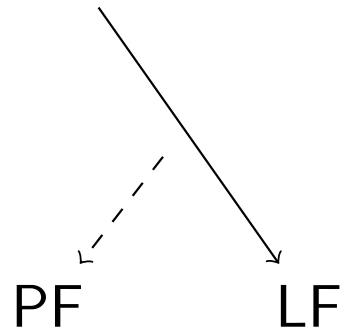
The reorientation towards semantics

- Over the course of the 1970s, syntactic representations became more like semantic representations.
  - Introduction of traces (Wasow 1972), arguments from (syntactic) anaphoric relations.
  - Demonstration that traces are like variables and not like phonological objects (Chomsky 1976).
  - Arguments that syntactic locality constraints restrict scope inversion (May 1977).
- All of this allowed syntax to annex part of semantics.
- This prompts a reorientation of Chomskyan syntactic theory (1981–1993).
  - Syntax is the study of syntactic operations and relations, not the order of words in sentences (also Morgan 1969).
  - D-structure isn't very important to syntax as recoverable from S-structure (Chomsky 1981).
  - LF is syntactic.
  - Small leap: Syntax generates LFs. Phonology is a by-product.

The Y-model: before



The Y-model: after



- Except that's misleading. That dashed line isn't really syntax.
- That's why it's dashed.

The Y-model: really after

- Not shown: minimal path from LF to real-semantics; long and wild path from PF to real-phonology.
- Current Minimalist assumptions allow a couple of variants:
  - Single-output syntax: shift PF down to the same place as LF. Covert movement is visible at PF as well as LF. PF chooses not to make it overt.
  - Phases: cyclical single-output syntax?

Locality to the fore

- Strikingly, the original motivation for the reorientation towards semantics has disappeared in the process.
- Traces no longer look like variables. Traces are copies. To make them look like variables (better: look like structures containing variables), you need to do something *post-syntactic* (e.g. trace conversion, Fox 2002).
- Corollary: the syntax–semantics interface is far from transparent.
  - It can replace determiners with other determiners.
  - It can insert λ-operators and variables for them to bind.
  - I wouldn't bet against it being able to alter hierarchical relations (e.g. attach quantifiers to nodes of the appropriate type) — see Lechner (2013) for one implementation.
- To maintain the orientation of syntax towards semantics, we really need to see something clearly syntactic about semantic phenomena like scope inversion (locality is the obvious bet).
- Otherwise, it's hard to justify this distinctive architectural property of minimalism.

These talks

The hope

- I want to construct an empirical argument that there is no level of LF with the following properties.
  - a phrase-structural representation
  - which represents aspects of meaning not explicitly represented at the surface
  - and is constructed from surface representations by covert movement and/or operations making special reference to movement.
- If the argument goes through, it also suggests that there is no movement or equivalent (copies, etc.). Rather, movement is a composite of simpler, dissociable relations.
- I think this argument suggests a certain approach to the syntax–semantics interface, or the broader question of what lies beyond the surface. I'll be arguing for less syntax and more interface.

These talks

The plan

- Three interrelated topics.
  1. Today: status of the copy theory of movement, and alternatives. Data mainly from Lechner (1998).
     - First less ambitious goal: make sense of Lechner.
  2. Tomorrow: looking beyond Lechner's data, interactions between grammatical dependencies and scope and binding effects.
     - Second less ambitious goal: demonstrate reconstruction effects which aren't contingent on movement.
  3. Friday: attempts to put a theory of the syntax–semantics interface in place. Likely noble failure. Messy.

Today

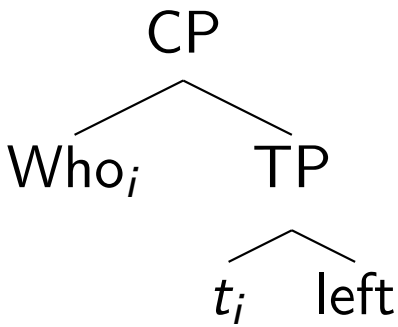
1. What are copies for?
2. Copies and QR
3. Lechner's two types of reconstruction
4. Representing dissociations and interactions

Section 1

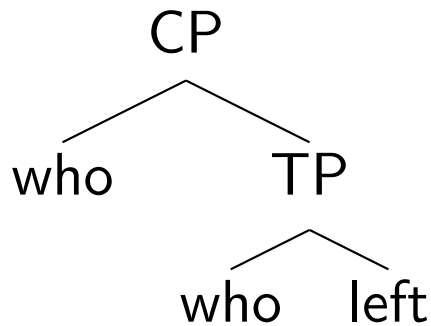
What are copies for?

Not just notation

- Chomsky (1993) advocated a shift from this:



. . . to this:



- He had his reasons:
  - Inclusiveness
  - Elimination of levels of representation
  - Ease of accounting for reconstruction effects

Levels of representation

- GB conception of movement: a relation between levels of representation.
- X moves iff there exist levels L_1, L_2 such that X occupies different positions at L_1 and L_2.
- Other paraphernalia (traces, indices) is necessitated by a need to preserve most information from earlier levels in later levels.
- But a sufficiently rich post-movement representation doesn't require us to preserve its derivational history (see already Chomsky 1981: DS relations are preserved in SS representations, so DS is dispensible).
- So eliminating levels of representation does not require substantial change to "the" representation.

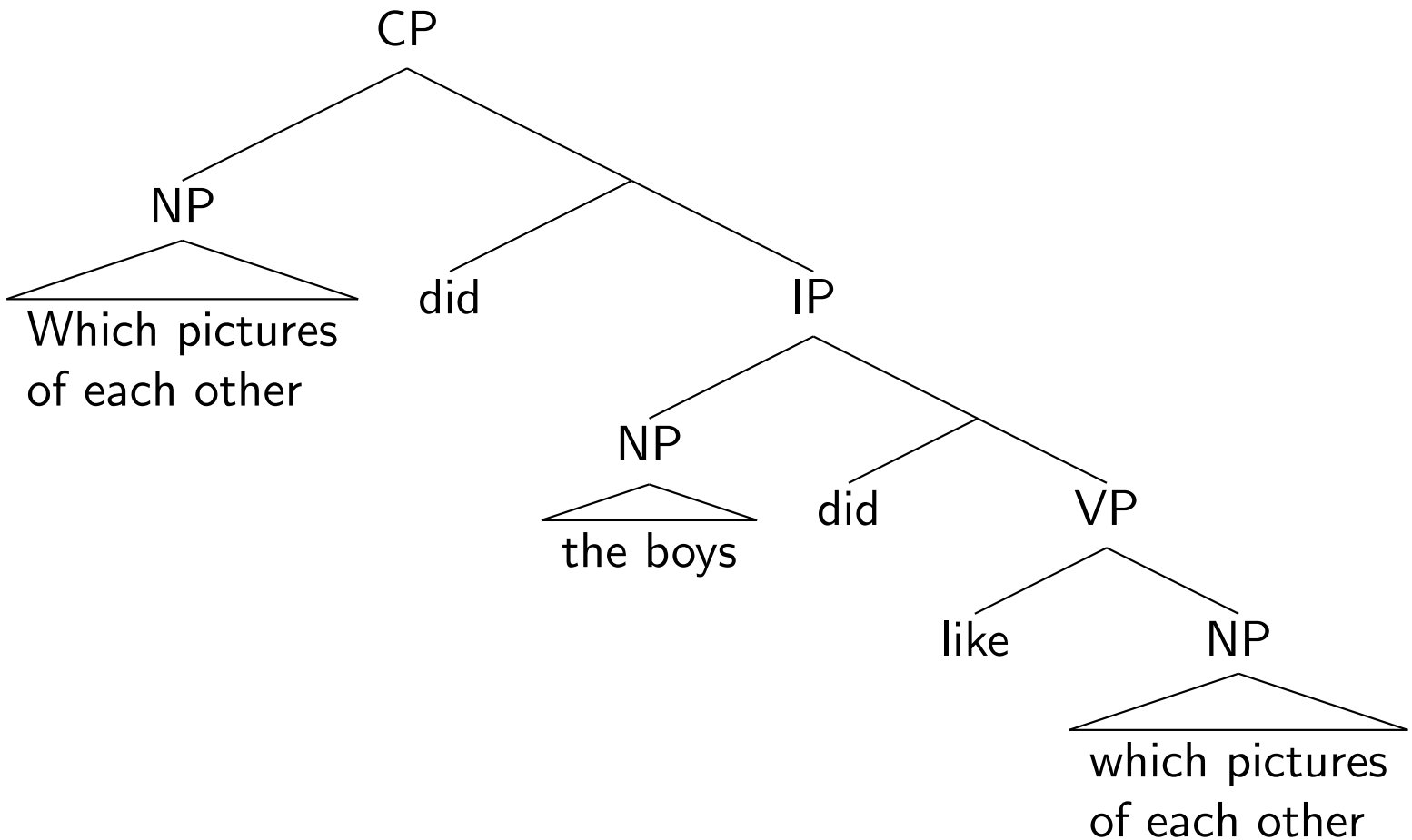
Inclusiveness

- This conception of representations with traces is also the key to seeing that those representations are compatible with Inclusiveness.
- Neeleman & van de Koot (2002) worked this out first: a monostratal minimalist syntax with traces.
- Several options compatible with their insight (especially as Reverse Agree is on the rise).
- So there is no good argument for the copy theory from elimination of levels of representation or inclusiveness.
- Arguments for copy theory will hinge on reconstruction.

Reconstruction

- Principle A: a reflexive must be locally c-commanded by its antecedent.

(1) [Which pictures of each other$_i$] did the boys$_i$ like?



Other approaches to reconstruction

- This pattern doesn't require the copy theory. Other approaches:
  - Bespoke rules (Chomsky 1977). *But: rules*
  - Lowering (May 1977). *But: extension condition*
  - NP-structure/timing of operations (van Riemsdijk & Williams 1981). *But: levels of representation*
  - Chain-based binding theory (Barss 1986). *But: inclusiveness*

  So copies it is (or so the story goes).

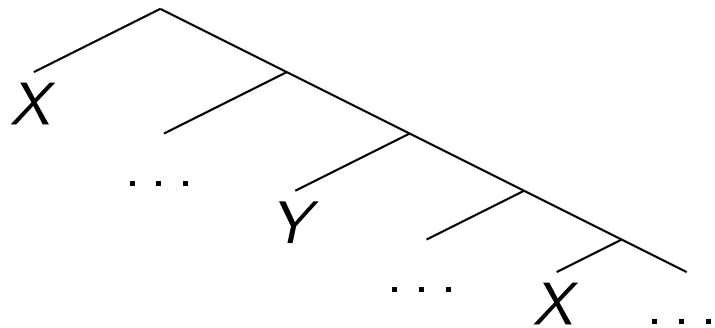
Section 2

Copies and QR

Two ways to invert scope

- Whatever technology handles reconstruction for Principle A in (1) can also satisfy reconstruction for other properties.
- E.g. scope relations. In the configuration in (2), X could take scope over Y (interpret top copy) or *vice versa* (interpret bottom copy).

(2)

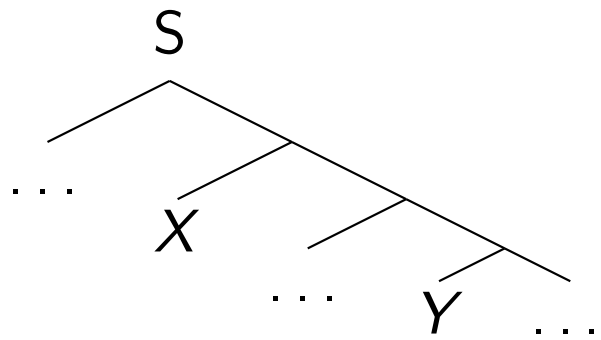


(Assumes that post-reconstruction c-command relations translate directly into semantic scope).

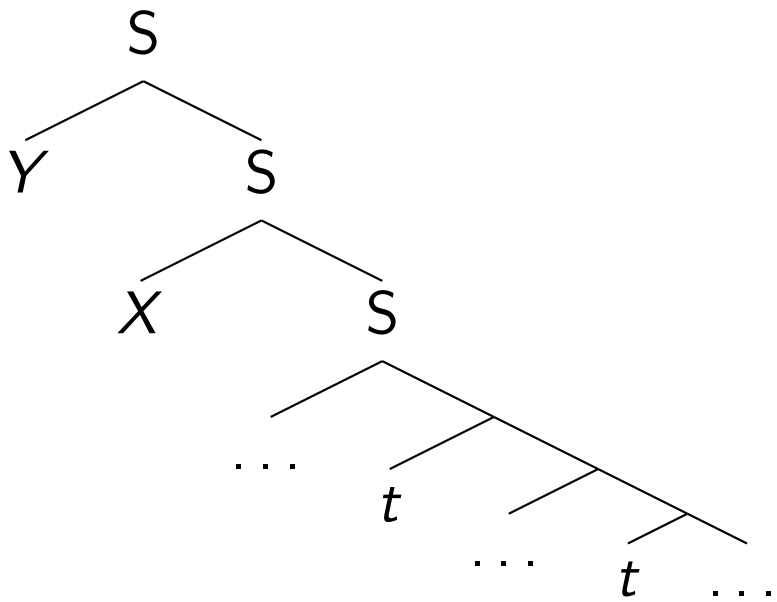
- This treads on the toes of Quantifier Raising (covert movement), another movement-based mechanism for capturing scope inversion.
- QR: Adjoin Q (to S) (May 1977: 18)
- LF c-command reflects scope relations.

Scope inversion with QR

- SS:



- LF:



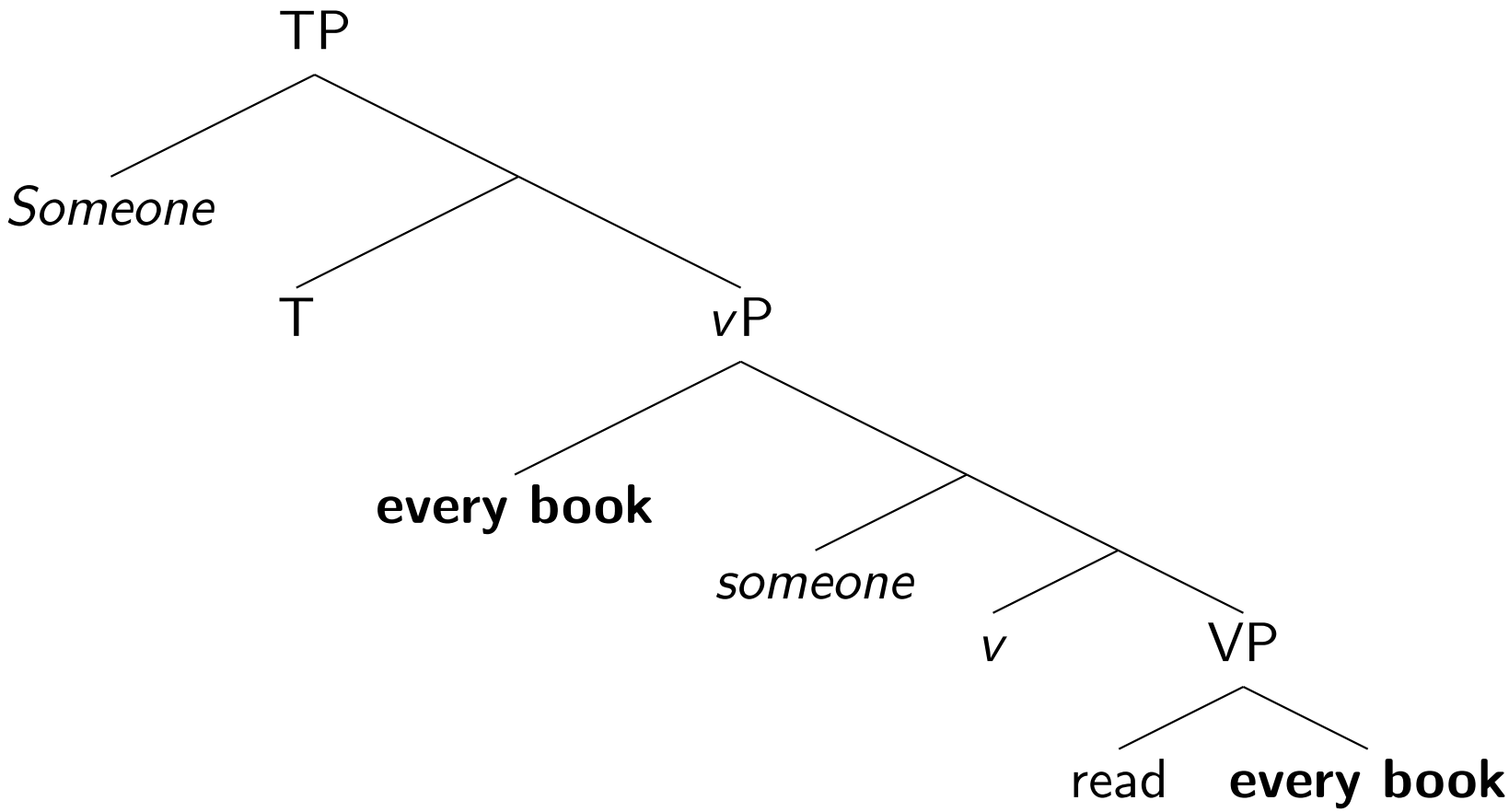
Division of labour

- QR does not feed or bleed binding relations.

  (3) a. *Himself cooks for every boy
  b. The twins like everything about each other.

- So you can't just pass post-QR representations to semantics.
- GB solution: binding relations (mostly) determined pre-LF, represented by indices which persist at LF.
- *But: levels of representation*.
- Workarounds exist, but a neat alternative would be to see reconstruction shoulder the empirical load that QR was designed for.
- This is possible because of the VP-internal subject hypothesis + raising to object (Aoun & Li 1989, Hornstein 1995).

Scope inversion by reconstruction



But we need QR

- Two main types of objection to a total reduction of scope inversion to reconstruction:
  1. Quantifiers take scope over propositions in semantic representations.

     (4) $\forall x(\lambda x.\text{book}'(x))(\lambda x.\exists y(\lambda y.\text{person}'(y))(\lambda y.\text{read}'(y,x)))$

     So if your final syntactic representation has quantifiers buried within clauses, you're going to need to say something more to guarantee any relation to the position of quantifiers in semantic representations.
  2. Antecedent-Contained Deletion.

     (5) John [$_{\text{VP}}$read every book Bill did $\emptyset$]

     - Copying VP into the ellipsis site gives rise to a regresss.
     - QR followed by copying doesn't.

     (6) [every book Bill did $\emptyset$] John [read t]

Must QR be syntactic?

- Both arguments imply that quantifiers occupy higher positions in structured semantic representations than in structured syntactic representations.
- Neither automatically implicates movement in getting to that higher position.
  - Don't forget: the syn–sem interface is not transparent, so unless you want to argue that there's nothing like movement outside syntax, "getting to a higher position" does not implicate syntax.
- E.g. to avoid the regress with ACD, all you need is some way of separating restriction and scope. Any semantic representation does that.
- And so we come back to locality again.
- Difficult to evaluate when locality theory is a moving target, but my impression is that that argument cannot be made.

QR and locality

A bulletproof idea

- The history of QR and locality doesn't bode well.
- Chomsky (1976): QR is sensitive to weak cross-over (**His mother loves every boy*).
  - But this could equally well show that binding relations are determined prior to QR (van Riemsdijk & Williams 1981).
  - Evidence for QR feeding bound varible anaphora is equivocal even when WCO is irrelevant (*someone in every city despises it*, but **La femme près de chaque homme ressemble à sa mère* (Haïk 1984).
  - If WCO really is about leftness, making it constrain covert movement could be tricky.

QR and locality

A bulletproof idea

- May (1977): QR obeys Subjacency (clause-boundedness, interactions with *wh*-phrases).
  - Except it's not like overt Subjacency: only S is a bounding node (otherwise no inverse linking).
  - And you need another scope inversion mechanism at LF′.
  - And covert *wh*-movement does not show classic Subjacency effects (Huang 1982, but cf. Nishigauchi 1990).

QR and locality

A bulletproof idea

- Kayne (1981), Chomsky (1981): QR obeys the ECP (*ne . . . personne*, superiority).
  - But there's more to Superiority than that.
  - And Kayne's argument requires bespoke assumptions regarding long-distance QR that don't naturally generalize to more core cases like scope inversion.
- May (1985, ch.5): QR obeys the Path Containment Condition (because of QR from positions that aren't properly governed: only "interacting" QR is restricted).
  - And this kind of works.
  - But he needs to include non-movement paths to account for WCO and *ne . . . personne*.
  - Which raises the question, why do you need movement paths in the other cases?

QR: line of best fit

- GB-era locality constraints don't seem to constrain covert movement in the same way as overt movement.
- Minimalist locality constraints are typically less helpful.
  - Many assume feature-based movement; QR typically isn't assumed to be feature-driven.
  - Others (e.g. Multiple Spell-Out, Uriagereka 1999) at best recapitulate GB-era constraints.
  - Persistent background question of domain-generality of certain constraints ("least effort", "parallelism").
- Much recent work (e.g. Fox 2000) has sharpened our understanding of scope inversion, without relying on classical locality constraints.
- Best fit seems to be to assume QR is not syntactic movement.
- Any syntactic constraints on scope relations would then be implemented through reconstruction.
- But to make that work, we'd need to translate asymmetric c-command relations into scope relations.

Section 3

Lechner's two types of reconstruction

Partial reconstruction

- Scope and binding are usually yoked together.
- This is partly a matter of semantic well-formedness.
- A quantifier can bind a variable in its scope, etc.
- Partial reconstruction (Chomsky 1993) was an early example of how this simple picture can get complicated.

  (7) Which ~~pictures of each other~~ did the twins see ~~which~~ pictures of each other?

- Reconstruction for Principle A, leaving the operator in its scope position.
- Such a pattern encourages us to investigate the scope and binding properties of a phrase in isolation before looking at interactions.

Separating scope and binding

Scope reconstruction only

- Lechner (1998) demonstrated that there are constructions in which reconstruction for scope and binding can be dissociated.
- German A-scrambling has scope reconstruction without binding reconstruction.

(8) weil sie [ein Bild von seinem$_{*i}$ Auftritt]$_j$ jedem Kandidaten$_i$ t$_j$ zeigte.
since she a picture of his appearance every candidate showed
'since she showed every candidate a picture of his appearance'
($\exists > \forall, \forall > \exists$, Lechner 1998:299)

Separating scope and binding

Binding reconstruction only

- Extraction from weak islands has binding reconstruction without scope reconstruction.

(9)
a. It's [to herself$_i$/*her$_i$] that I don't know [whether Mary$_i$ wrote __].
b. *It's [to Mary$_i$] that I don't know [whether she$_i$ wrote __].
c. It's [to her$_i$ mother] that I don't know [whether every girl$_i$ wrote __].

(10) [How many books] do you wonder [whether Chris wants to buy __]? (many > want, *want > many)
a. 'There are three books that I wonder if Chris wants to buy: *Dubliners*, *Ulysses*, and *Finnegans Wake*.'
b. *'I wonder whether Chris might be interested in buying three books, but I don't care whether Chris might be interested in buying two books or four books.'

Separating scope and binding

Binding reconstruction only

(11) a. Every boy must see five pictures from the teacher's childhood before he can go home. The teacher must oversee this process, but hasn't paid attention, so he is now unsure who has seen which pictures.

Question: How many pictures from his_i childhood does the teacher_i need to know whether every boy has seen?

b. Every boy must see five pictures from his own childhood before he can go home. The teacher must oversee this process, but hasn't paid attention, so he is now unsure who has seen which pictures.

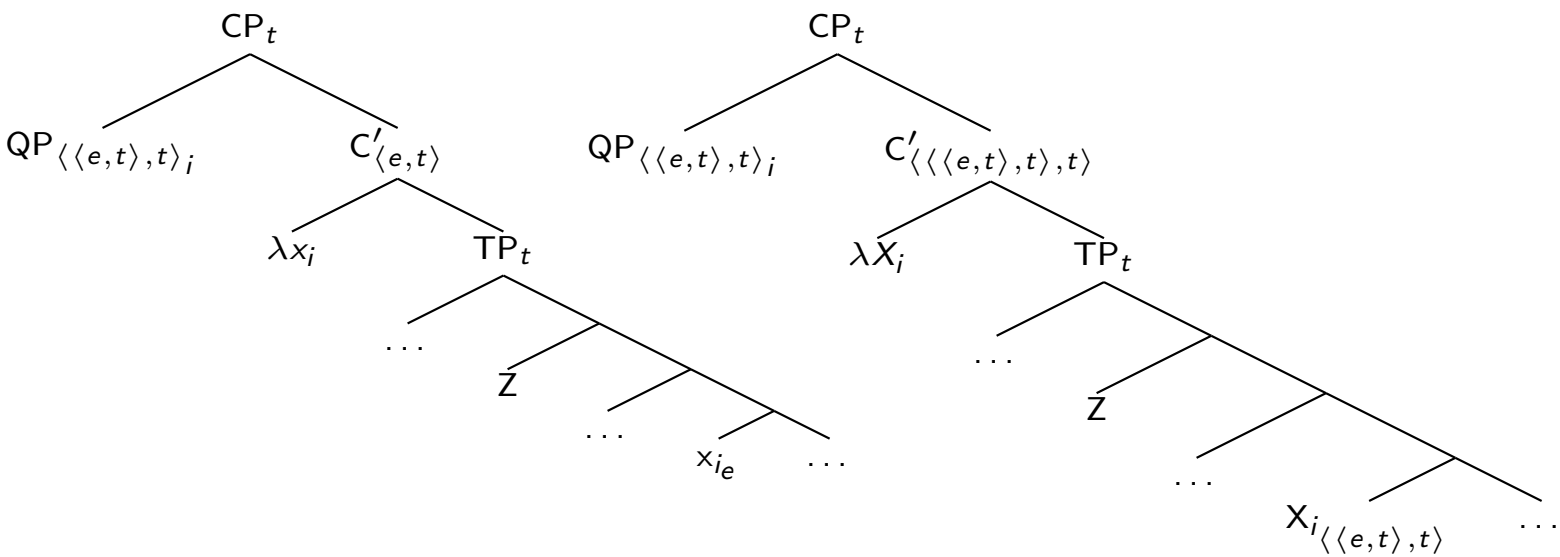
Question: *How many pictures from his_i childhood does the teacher need to know whether every boy_i has seen?

Section 4

Representing dissociations and interactions

Lechner's analysis

- Lechner tied each type of reconstruction to a different reconstruction mechanism.
- SynR: Lower copy interpretation $\rightarrow$ binding reconstruction.
- SemR: Higher-type (e.g. $\langle\langle e, t\rangle, t\rangle$) trace $\rightarrow$ scope reconstruction.



Lechner: Comments

- Let's invent some terminology:
  - Scope chain $\approx$ tuple of constituents $\langle x_1, \ldots, x_n \rangle$ such that x_1 can take scope in the position of x_n.
  - Binding chain $\approx$ tuple of constituents $\langle x_1 \ldots, x_n \rangle$ such that x_1 can be bound from the position of x_n.
- For Lechner, the foot of a scope chain (higher-type trace) and the foot of a binding chain (copy) are different objects (for Lechner, they occupy different positions).
- That means that interactions between scope and binding don't fall out very naturally.
- We're particularly interested in trapping effects (May 1977, Fox 1999).

Trapping effects

- Binding relations bleed scope relations.

(12)
a. [At least one soldier]$_1$ seems (to Napoleon) [t_1 to be likely to die in every battle] $\exists > \forall, \forall > \exists$
b. [At least one soldier]$_1$ seems to himself$_1$ [t_1 to be likely to die in every battle] $\exists > \forall, *\forall > \exists$
c. [At least one soldier]$_1$ seems to his$_1$ commanders [t_1 to be likely to die in every battle] $\exists > \forall, *\forall > \exists$, (Fox 1999: 160)

- This forces us to countenance interactions between scope chains and binding chains.
  - If $C_1 = \langle \ldots, x_i, \ldots \rangle$ is a scope chain and $C_2 = \langle \ldots, x_i, \ldots \rangle$ is a binding chain,
  - and binding relations are determined in the position of x_i,
  - then scope relations must also be determined in the position of x_i.

Copy theory, trapping effects, and dissociations

- Copy theory can capture such interactions quite naturally:
  - Delete every copy of x except one.
  - Interpret whatever's left.
- But copy theory struggles with Lechner's dissociation: copies don't come marked as "scope copy only" or "binding copy only".
- Copies contain enough information to make trapping effects natural, but contain so much information that dissociations have to be captured extrinsically to the copies themselves.

An alternative

Multiple chains

- Imagine instead:
  - Scope chains and binding chains are distinct objects (Lechner).
  - But they're formed from the same kinds of components (everyone else).
  - Those components don't include copies (too information-rich).
  - If a constituent doesn't take scope, it doesn't have a scope chain (and likewise for binding chains).
  - Every constituent must be interpreted in a single position (trapping effects).
- The aim is to capture two generalizations (see also Truswell 2013):
  1. Trapping: You can only enter into binding relations from your scope position (partial reconstruction aside).
  2. Countertrapping: If you don't enter into binding relations, extra scope positions might be available, and *vice versa* (Lechner).

Lechner's examples

(13) weil sie [$_X$ einem Bild von seinem Auftritt] jedem Kandidaten Y ziegte.

a. Scope chain: $\langle X, Y \rangle$
b. (Binding chain: $\langle X \rangle$)

(14) It's [$_X$ to herself] that Mary doesn't know whether to write Y

a. No scope chain
b. Binding chain: $\langle X, Y \rangle$

(15) [$_X$ How many pictures from his childhood] does the teacher need Y to know whether every boy has seen Z?

a. Scope chain: $\langle X, Y \rangle$
b. (Binding chain: $\langle X, Y, Z \rangle$)

Interim summary

- There's some tensions between reconstruction and QR in capturing scope inversion phenomena.
- Various arguments have been given for the copy theory. The most persuasive ones involve reconstruction effects.
- Even so, copy theory struggles with dissociations between scope reconstruction and binding reconstruction.
- The pre-eminent theory of those dissociations (Lechner 1998) struggles in turn with interactions between the two types of reconstruction (particularly trapping effects).
- My proposed way forward is to keep Lechner's dissociations (scope chains vs. binding chains) but discard his theory of the syntactic instantiation of the two types of chain.
- This can help build a theory which captures the balance between trapping and countertrapping:
  - You take scope where binding theory lets you.
  - But if you don't enter into binding relations, you may be able to take scope somewhere else.
  - And *vice versa*.

Immediate to-do list

- How are scope and binding chains characterized?
- How do they relate to movement chains?
- How do we state binding theory in terms of binding chains?
- How do we make this talk of chains compatible with Inclusiveness?

Rough answers

- Scope chains are a subset of grammatical dependencies. Binding chains hold among elements which share a θ-role.
- Movement chains are grammatical dependencies between elements that share a θ-role. In other words, movement chain $=$ scope chain $+$ binding chain.
- Luckily, we're not the first people to try all of this (Barss 1986 and Hornstein 1995 are clear precursors), so there are ready-made bits of chain-based theories to build on.
- Assuming that we independently need to know which elements are related by grammatical dependencies, and which elements share a θ-role, Inclusiveness isn't our problem.

Less cryptic answers tomorrow...

References

Aoun, J. & Li, Y.-H. A. (1989). Scope and constituency. *Linguistic Inquiry*, *20*, 141–172.

Barss, A. (1986). *Chains and Anaphoric Dependence: On Reconstruction and its Implications*. PhD thesis, Massachusetts Institute of Technology, Cambridge, MA.

Chomsky, N. (1976). Conditions on rules of grammar. *Linguistic Analysis*, *2*, 303–351.

Chomsky, N. (1977). On wh-movement. In P. Culicover, T. Wasow, & A. Akmajian (Eds.), *Formal Syntax* (pp. 71–132). New York: Academic Press.

Chomsky, N. (1981). *Lectures on Government and Binding*. Dordrecht: Foris.

Chomsky, N. (1993). A minimalist program for linguistic theory. In K. Hale & S. J. Keyser (Eds.), *The View from Building 20: Essays in Honor of Sylvain Bromberger* (pp. 1–52). Cambridge, MA: MIT Press.

Chomsky, N. & Lasnik, H. (1977). Filters and control. *Linguistic Inquiry*, *8*, 425–504.

Fox, D. (1999). Reconstruction, binding theory, and the interpretation of chains. *Linguistic Inquiry*, *30*, 157–186.

Fox, D. (2000). *Economy and Semantic Interpretation*. Cambridge, MA: MIT Press.

Fox, D. (2002). Antecedent-contained deletion and the copy theory of movement. *Linguistic Inquiry*, *33*, 63–96.

Haïk, I. (1984). Indirect binding. *Linguistic Inquiry*, *15*, 185–223.

Hornstein, N. (1995). *Logical Form: From GB to Minimalism*. Oxford: Blackwell.

Huang, C.-T. J. (1982). *Logical Relations in Chinese and the Theory of Grammar*. PhD thesis, Massachusetts Institute of Technology, Cambridge, MA.

Kayne, R. (1981). Two notes on the NIC. In A. Belletti, L. Brandi, & L. Rizzi (Eds.), *Theory of Markedness in Generative Grammar: Proceedings of the 1979 GLOW Conference* (pp. 317–346). Pisa: Scuola Normale Superiore.

Lechner, W. (1998). Two types of reconstruction. *Studia Linguistica*, *52*, 276–310.

Lechner, W. (2013). Harmonic derivationalism. In R. Folli, C. Sevdali, & R. Truswell (Eds.), *Syntax and its Limits* (pp. 19–43). Oxford: Oxford University Press.

May, R. (1977). *The Grammar of Quantification*. PhD thesis, Massachusetts Institute of Technology, Cambridge, MA. Distributed by Indiana University Linguistics Club.

May, R. (1985). *Logical Form: its structure and derivation*. Cambridge, MA: MIT Press.

Morgan, J. (1969). On arguing about semantics. *Papers in Linguistics*, *1*, 49–70.

Neeleman, A. & van de Koot, H. (2002). The configurational matrix. *Linguistic Inquiry*, *33*, 529–574.

Nishigauchi, T. (1990). *Quantification in the Theory of Grammar*. Dordrecht: Kluwer.

Truswell, R. (2013). Reconstruction, control, and movement. In R. Folli, C. Sevdali, & R. Truswell (Eds.), *Syntax and its Limits* (pp. 44–65). Oxford: Oxford University Press.

Uriagereka, J. (1999). Multiple spell-out. In S. Epstein & N. Hornstein (Eds.), *Working Minimalism* (pp. 251–282). Cambridge, MA: MIT Press.

van Riemsdijk, H. & Williams, E. (1981). NP-structure. *The Linguistic Review*, *1*, 171–217.

Wasow, T. (1972). *Anaphoric Relations in English*. PhD thesis, Massachusetts Institute of Technology, Cambridge,