

Semantic Ellipsis After All? Evidence from Focus and Higher-Order Boolean Antecedents.

Handout for Talk at Keio University, April 5, 2024

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1. Bound variable readings

BA Examples with (apparently) higher-order Boolean antecedents binding a property variable in the ellipsis site.

- (1) a. He's not exactly cooperative.
 b. But he either cooked or cleaned up without me asking him to. I forget which.
 (= Either he cooked without me asking him to cook, or he cleaned up without me asking him to clean up)

Higher order VP a la Rooth and Partee (1982), Partee and Rooth (1983):

- (2) Lower order Boolean interpretations of type *et*
 either cooked or cleaned up $\lambda x.\mathbf{cook}(x) \vee \mathbf{cleanup}(x)$
 being an *x* such that *x* cooked or *x* cleaned up
 both cooked and cleaned up $\lambda x.\mathbf{cook}(x) \wedge \mathbf{cleanup}(x)$
 being an *x* such that *x* cooked and *x* cleaned up
- (3) Higher order Boolean interpretations of type $((et)t)t$. \mathcal{P} is a variable of type $(et)t$.
 either cooked or cleaned up $\lambda \mathcal{P}[\mathcal{P}(\mathbf{cook}) \vee \mathcal{P}(\mathbf{cleanup})]$
 being a generalized quantifier \mathcal{P} such that
 \mathcal{P} contains **cook** or \mathcal{P} contains **cleanup**
 both cooked and cleaned up $\lambda \mathcal{P}[\mathcal{P}(\mathbf{cook}) \wedge \mathcal{P}(\mathbf{cleanup})]$
 being a generalized quantifier \mathcal{P} such that
 \mathcal{P} contains **cook** and \mathcal{P} contains **cleanup**

R&P is concerned with disjunction (or). The examples are possible with conjunction (and) as well.

- (4) a. Ted both graduated from college and retired before his older brother Bob did.
 b. Ted graduated from college before Bob graduated from college, and Ted retired before Bob retired.
 c. Ted both graduated from college and retired before Bob both graduated from college and retired.

Analysis with a bound property variable and a higher order quantifier:

- (5) Quantifier $\lambda \mathcal{P}[\mathcal{P}(\mathbf{graduatefromcollege}) \wedge \mathcal{P}(\mathbf{retire})]$
 Scope $[2_{set} [\text{Ted } e_{2_{set}} \text{ before his older brother Bob } e_{2_{set}}]]$
 Semantic gloss Both $\lambda wx.\mathbf{graduatefromcollege}(w,x)$ and
 $\lambda wx.\mathbf{retire}(w,x)$ satisfy the property of properties of
 of being a *Q* such that Ted did *Q* before Bill did *Q*.

There is a semantic derivation on the last page of the handout.

Schwarz (2001) Ch. 5, "Silent verb phrases as bound variables" discussed two kinds of examples involving focus and (apparently) bound property variables.

FA focused VP antecedent, and a covariant ellipsis VP

- (6) a. John cooked because he had to cook. Schwarz (2001) p. 156
 b. And he CLEANED UP_F because he had to.
 (= and he cleaned up because he had to clean up)
 d. Focus alternative of the form
 covariant 'John *Q* because he had to *Q*', rather than
 invariant 'John *Q* because he had to clean'.

The focus antecedent (??a) has the covariant form, not the invariant form. It has 'cook' in both *Q* slots.

Covariant readings of ellipsis with a focused antecedent are comparable to a covariant pronoun with a focused antecedent. Partee (1970) analogized such readings to bound variables. (The pronoun in (7b) can be stressed, but the example under discussion has an unstressed pronoun.)

- (7) a. Ava thinks her solution is working.
 b. And EMMA_F thinks her solution is working.
 Antecedent of the form 'y thinks y's solution is working', not 'y thinks Emma's solution is working'.

High-level form

We know there are covariant readings for pronouns with focused antecedents, and arguably such pronouns are bound variables. Since we observe covariant readings for ellipsis with a focused antecedent, we conjecture that VP ellipsis can have a pro-VP syntax and semantics. In covariant readings, the pronominal VP is a bound variable.

Schwarz said that VPE can have a syntax of an unstructured property variable. It can also have full ramified syntax. (9) has an LF with a bound property variable in the ellipsis site. The ellipsis site is not syntactically structured.

FAonly Focusing adverb scoping over
 a focused VP antecedent, and a covariant ellipsis VP

This is like the b. sentence of **FA**, with a focusing adverb outside.

- (8) Of all of the helpful things the Bob did, he only COOKED_F because he had to.

It excludes Bob cleaning up because he had to cleaning up (covariant), not cleaning up because he had to cook (invariant).

- (9) a. John cooked because he had to cook.
 b. He also CLEANED_F because he had to.

Here the focusing adverb is *also*.

CE\E ellipsis is an embedded sloppy-covariant element,
 under another ellipsis

- (10) You're not very consistent.
 When I sing, you ask me not to.
 When I WHISTLE_F, you don't.
 (= you don't ask me not to whistle).

It's comparable to a covariant reading (i.e. sloppy reading) for the individual type, with a focused type *e* antecedent in the local clause. In (11b) the focused clause-local antecedent is EMMA_F, while in (10) it is WHISTLE_F.

- (11) a. When Ava asks you to help her, you try to help her.
 b. When EMMA_F asks you to help her, you don't.
 (= you don't try to help Emma)

2. Connectivity

This is the phenomenon of syntax outside the ellipsis site apparently interacting with syntax inside the ellipsis site, or what would be syntax inside the ellipsis site if the ellipsis site is syntactically structured. We concentrate on varieties of connectivity having to do with bound variables.

WH-extraction from ellipsis site

Literature back to Sag 1976, Williams 1977.

- (12) I know what₁ Amy put e₁ in the box.
 I don't know what₂ Bob did ~~put e₂ in the box~~

In the structure above, the deleted VP has a free variable of type *e* and index 2. A deep predicate anaphor is impossible.

- (13) *I don't know what₂ Bob did it/that/so.

(I find the *so* version better than the others.)

This makes sense if deep predicate anaphors are syntactically atomic, and contribute properties semantically.

Degree binding into the ellipsis site

Comparatives are analyzed with overt or covert A-bar movement and LF binding of a degree variable.

- (14) *Sub-deletion comparative* Keisha and Justin both own construction companies. Keisha is far more active and successful.
 She has bought more building lots than Justin has bought two-by-fours.

- (15) [[-er d][[Keisha has bought [d building lots]]] than [Justin has bought [d two-by-fours]]]

Or with degree binders in each clause:

- (16) [-er [λd [[Keisha has bought [d building lots]]]] than [λd [Justin has bought [d two-by-fours]]]]

The above is comparative sub-deletion. All comparatives have LFs like this with degree binding, possibly additional overt movement and binding, and varying degrees of ellipsis (von Stechow 1984, Heim 2000, Lechner 2004).

- (17) a. Keisha ate more cookies than Justin ate. *Comparative deletion*
 b. Keisha ate more cookies than Justin did. *Overlay of VPE*

When there is an overlay of VP ellipsis, the deleted VP has a locally free degree variable. This seems to conflict with the hypothesis of a pro-VP of property type.

- (18) [[-er d][[Keisha ate [d cookies]]] than [Justin did [eat [d-cookies]]]]

A deep anaphor is impossible.

- (19) *Keisha ate more cookies than Justin did it/that.

3. Bound variables with connectivity

Method

Look at constructions we think have variable binding into VP

Check whether bound variable readings are possible

Confirm with deep anaphora that there is variable-binding connectivity

FA with comparative

- (20) She broke more units than she was expected to.
But she also REPAIRED_F more units than she was expected to.
Covariant alternative: she *R* more units than she was expected to *R*
- (21) She repaired more units than she was expected to.
No, she only BROKE_F more units than she was expected to.
- (22) * She also REPAIRED_F more units than she was expected to do it.

BA with comparative

- (23) She both damaged and repaired more units than she was expected to.
= She damaged more units than she was expected to damage, and repaired more units than she was expected to repair.
- (24) She either damaged and repaired more units than she was expected to. I forget which.
- (25) * She both damaged and repaired more units than she was expected to do it.

CE\E with comparative

- (26) Our CEO is not careful about financial regulations.
Last year he bought more company stock than he is allowed to under SEC regulations.
THIS_F year he SOLD_F more than he is.
= he sold more than he is allowed to sell under SEC regulations

It's not possible to apply the deep anaphora test, because the relevant ellipsis is embedded under the higher ellipsis.

CE\E with relative clause WH movement

- (27) Example modified from Tomioka (2008)
- A: Fred is such a careful student.
He buys the books he is required to.
- B: True, but he only READS_F the books he ISN'T_F
= he only reads the books he required to read

Tomioka said examples with this configuration were good.

It's not possible to apply the deep anaphora test, because the relevant ellipsis is embedded under the higher ellipsis.

BA with relative clause WH movement

- (28) a. This year our CEO was not careful about SEC regulations.
He both purchased and sold stocks that he wasn't permitted to.

- b. Both **purchase** and **sell** are an R such that he R stocks he wasn't permitted to R .

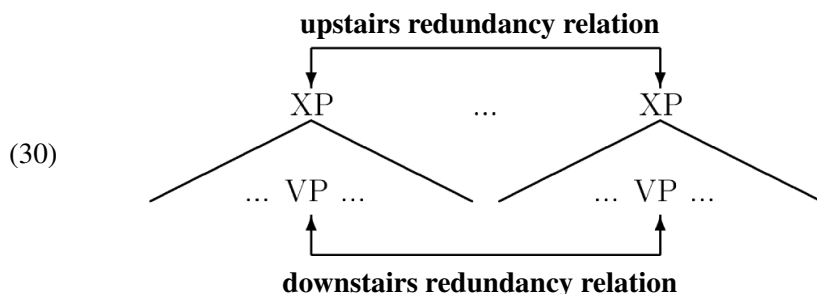
FA with relative clause WH movement

- (29) He sold stocks he wasn't allowed to.
 No, he only PURCHASED_F stocks he wasn't allowed to.
 The sole relevant R such that he R more stocks than the was allowed to R is **purchase**.

4. Focus licensing of ellipsis

This is the hypothesis from Rooth (1992) and Tancredi (1992) that ellipsis is in part licensed by focus. The theory of focus rather than the theory of ellipsis per se are the locus of explanation for covariant readings/sloppy identity, or in general for constraints on the indices of traces and pronouns “inside” the ellipsis.

Two-level architecture for ellipsis from *Indices and Identity* (Fiengo and May, 1994).



According to Rooth 1992, the upstairs relation is focus anaphoricity at the propositional level, as expressed in alternative semantics. The motivation has to do with long-distance cases of sloppy/covariant readings

- (31) Candidate A hopes Donald will support her₁.
 Candidate B_{F,2} hopes he won't_F support her₂
 covariant Candidate B hopes Donald won't support Candidate B
 invariant Candidate B hopes Donald won't support Candidate A

Focus without ellipsis has the same reading.

- (32) [Candidate A]_{1,F} hopes Donald will support her₁]₃.
 [Candidate B]_{2,F} hopes he won't_F support her₂]

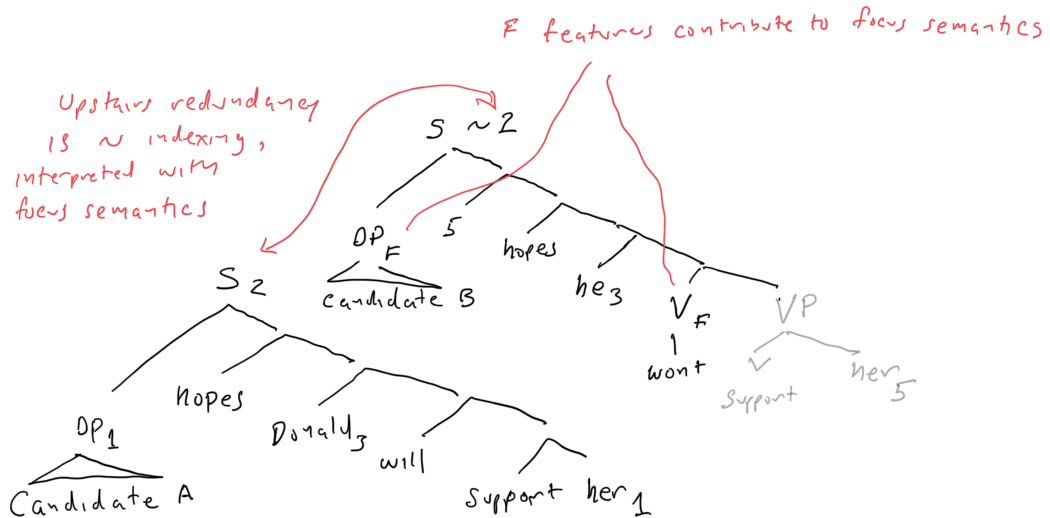
The second sentence has a covariant reading for the pronoun with a focused antecedent, because the focus antecedent has the form 'y hopes Donald will support y' (covariant), and not the form 'y hopes Donald will support Candidate B' (invariant).

Earlier theories of covariant readings referred only to the ellipsis and antecedent VPs (Williams 1976, Sag 1976).

- (33) Amy₁ thinks her₁ poem is embarrassing.
 Sue₂ does think her₂ poem is embarrassing too.

They referred to a closed VP meaning $\lambda x[x$ thinks x 's poem is embarrassing] that is shared between the antecedent VP and ellipsis VP. This is insufficiently general, it does not cover long-distance cases like (31). The problem was discovered around 1986.

(34)



Hypothesis from 1992

The interpretation of pronouns and traces inside ellipsis has nothing immediately to do with ellipsis. It follows from the interpretation of pronouns with focused antecedents. When there is ellipsis there has to be a focus, and this is what constrains the interpretation of pronouns and traces.

5. Ramified syntax and downstairs redundancy

In accounts of grammar with movement (basic transformational grammar, Principles and Parameters, Minimalism) connectivity motivates the hypothesis that the ellipsis site is syntactically structured. Merchant (2001) suggested this architecture.

(35) **Syntax** Ellipsis sites have full, nearly standard, ramified syntactic derivations.

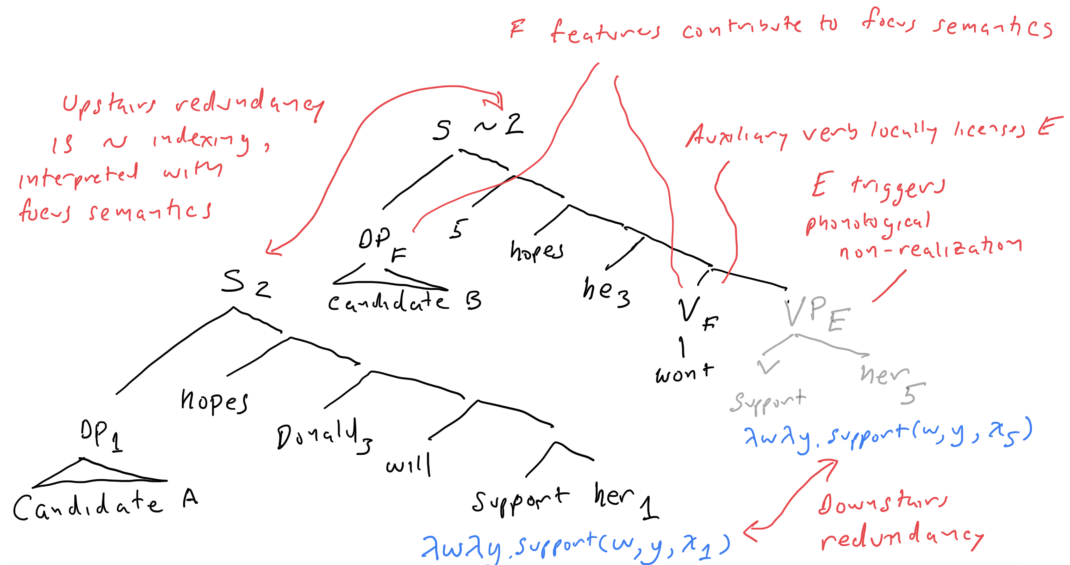
Phonology A local feature E triggers null phonological realization.

Local Syntax E is locally licensed, usually by specifiers.

Compositional Semantics Ellipsis sites have standard compositional semantics.

Focus Licensing of Ellipsis Merchant has his own version.

(36)



Although a superordinate focus is required for ellipsis, it is not sufficient.

- (37) a. Ann was reading a magazine, and Bob_F was reading, too.
b. Ann was reading a magazine, and Bob_F was ~~reading~~, too.
c. Ann was reading a magazine, and Bob_F was ~~reading a magazine~~, too.

There has to be an additional constraint. For Fiengo and May, this is “syntactic reconstruction”: the ellipsis VP is a syntactic copy of the antecedent VP, with some allowance for variation. Notably indices can be changed freely. In the wh example below, the trace index is 1 in the antecedent and 2 in the ellipsis area. The two VPs still stand in the reconstruction relation.

- (38) [I know what₁ JOHN_F put e₁ in the box]₂] but
[I DON'T_F know what₂ BILL_F did ~~put e₂ in the box~~] ~ 2.

Re-indexed wh-traces, just like re-indexed \bar{A} , are licensed by focus/parallel structure. This is a case of focus licensing of ellipsis (Schuyler, 2001).

For another case, there can be a trace in the antecedent and a pronoun in the ellipsis VP. The VPs still count as downstairs-equivalent.

- (39) [what books]₁ did John [read e₁] before Bill ~~read them~~_T

I assume a semantic version of downstairs redundancy. Downstairs redundancy enforces identity of semantics, ignoring indices, and allowing e.g. an indexed trace to change into an indexed pronoun.

6. Generalized bound variables

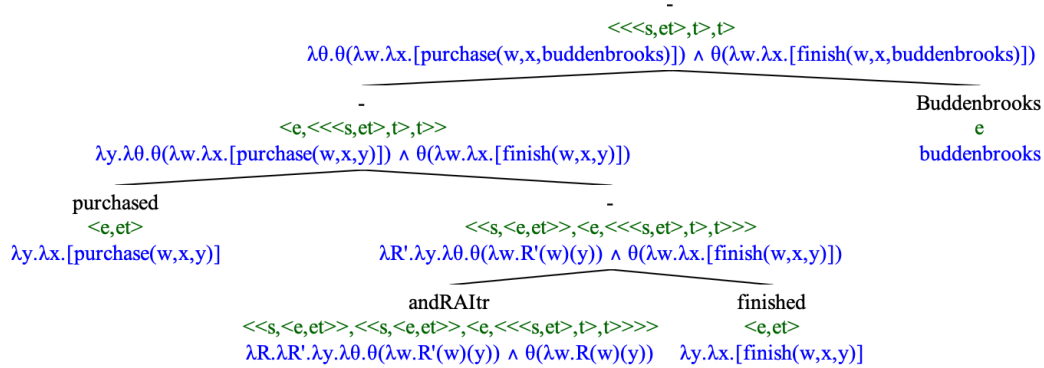
In some cases, the higher order variable seems to correspond to something smaller than VP.

- (40) Amy read the required novels before Sonia did.
No, she only BOUGHT_F the required novels before Sonia did.
- (41) Amy either bought or read the required novels before Sonia did. I forget which.
- (42) a. Amy both bought and read the required novels long before Sonia did.
b. Strong distributed reading:
Amy bought the required novels long before Sonia bought the required novels, and
Amy read the required novels long before Sonia read the required novels.

Possibly, ellipsis VPs can embed higher order variables of various types. The examples seen earlier where the bound variable corresponds to the whole VP is a special case. (Option **V**, variables of various higher order types)

Alternatively, combinations of scoping and type raising generate a suitable antecedent for a bound property variable, even when the focused element or conjunction is smaller, such as a transitive verb. (Option **P**, property variable in the ellipsis site)

(43) Higher order VP



It has the right distributing semantics. See the complete derivation at the end.

7. Higher order variables in the ellipsis site

Plot that maintains consistency with the ramified-syntax architecture

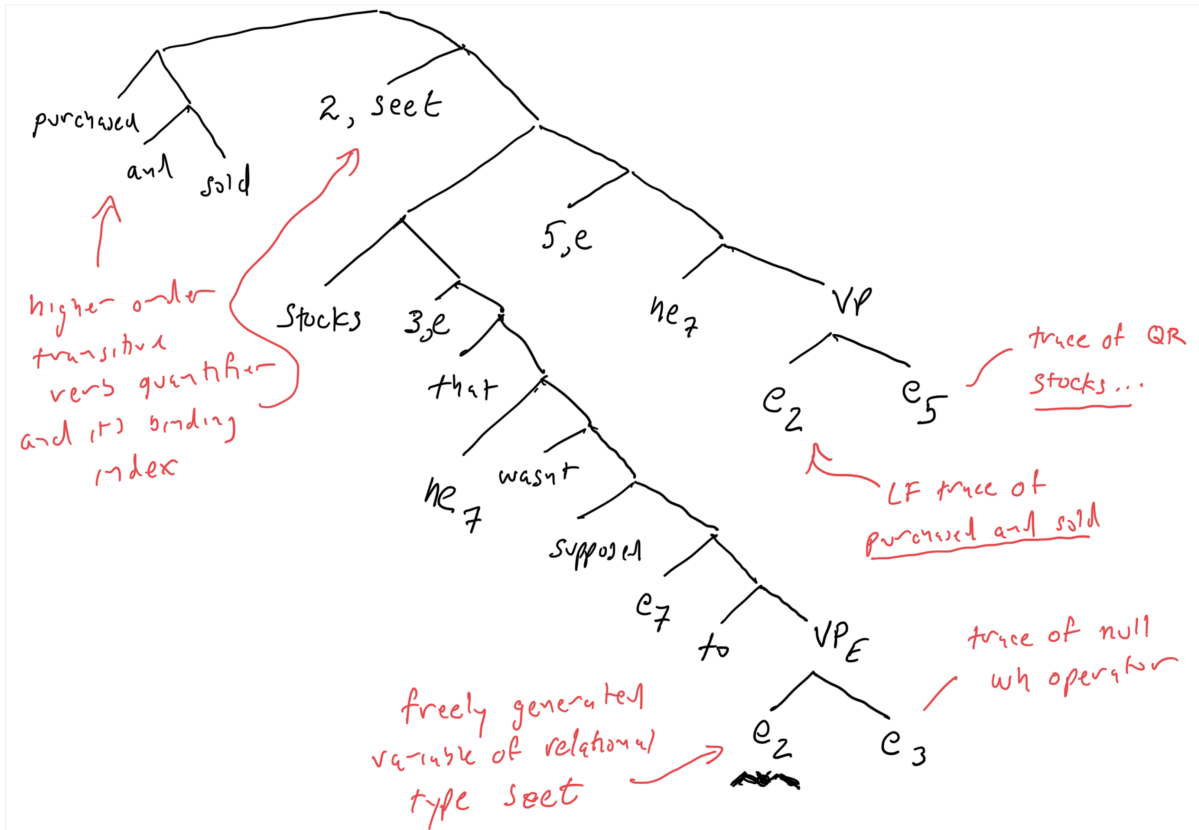
- (i) Wide-scoping *or*, wide-scoping *and*, and focus are ways of generating operators that can potentially bind higher order variables elsewhere in the LF.
- (ii) Often there are no higher-order variables for them to bind in ordinary syntax, except for the trace they generate by LF movement.
- (iii) But in ellipsis sites, higher-order variables can occur freely or comparatively freely. When they are present, they are bound if one of the operators in (i) is coindexed with them and scope over them.
- (iv) Like other indexed variables, the higher-order variables are constrained by upstairs and downstairs redundancy.

(44) Implementation

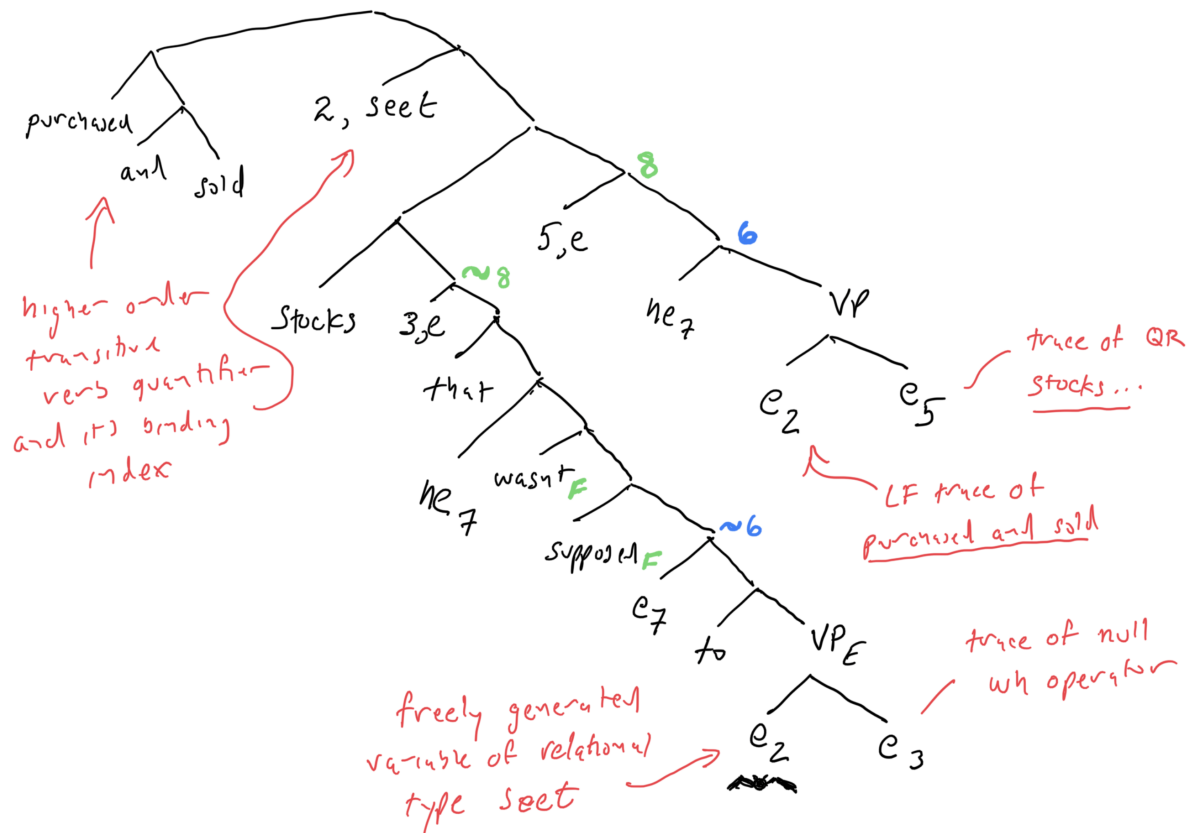
syntax	type	phonology	gloss
VP[e] _k	<i>set</i>	☞☞☞	bindable null VP
V[e] _k	<i>seet</i>	☞☞☞	bindable null transitive V

☞☞☞ has to be deleted in the phonology to keep the derivation from crashing.

(45)



(46)



8. Polymorphic strategy

What is semantically copied in VPE is polymorphic. In simple cases, it is a property, type *set*. But when there is a free trace, it is a relation, type *set*. When there is a free degree variable, it is a relation between a degree and an individual, type *set*.

- (47) [_{VP}purchase t₂]
 syntactic category VP
 free trace with index $\langle 2, e \rangle$
 semantic type *et*
 semantics value $\lambda x. \mathbf{purchase}(x, g(2))$, relative to assignment function *g*

- (48) [_{VP}purchase t₂]
 syntactic category is VP/NP or VP^{NP}
 semantic type is *et*, where the first *e* corresponds to the trace
 semantics is $\lambda y. \lambda x. \mathbf{purchase}(x, y)$, with no reference to an assignment function.

The syntactic category indicates how to decode the argument positions of the semantics. Some arguments are decoded as real arguments, others as free traces, others as pronouns, etc. Anything that in a standard system has a free variable coming from unbound index now has an extra argument position.

Free-variable-free semantics is a technical methodology for semantics and pragmatics, which uses closed terms of lambda calculus to model the semantic and pragmatic objects one reasons about.

- (49) Analogy: free-variable free information states in dynamic semantics

A man walked in. He patted a donkey.

$\lambda w. \lambda x. \lambda w [\mathbf{man}(w, x) \wedge \mathbf{donkey}(w, y) \wedge \mathbf{walkin}(w, x) \wedge \mathbf{pat}(w, x, y)]$

λw forms a proposition. The extra argument positions are interpreted as discourse referents. The type of information states is polymorphic, because there can be any number of discourse referents.

Free-variable-free semantic style is compatible with indices in syntax. One has to keep track of extra information in “interface signatures”.

- (50) $\lambda y. \lambda x. \lambda w. \mathbf{purchase}(w, x, y)$
 e 2 trace
 e – argument
 s – world

Idea: Ellipsis picks up a discourse referent for the variable-free semantics of the antecedent.

- (51) An author who₃ Justin admires e_3 and Keisha doesn't —.
 (52) Semantics shared between the antecedent and the ellipsis site, via a discourse referent or bound variable of type *set*

$\lambda w. \lambda y. \lambda x. \mathbf{admire}(w, x, y)$

- (53) Interface annotations for the antecedent

s – world
 e 3 trace
 e – argument

- (54) Interface annotations at the ellipsis site.

s – world
 e 3 trace
 e – argument

At the ellipsis site there is a pro-VP of type *eeest*. It has the same interface features as found for a non-ellipsis version.

Long-distance covariant reading

(55) Justin₁ asked Amelia to help him₁, and Jaden_{2,F} asked Olivia_F to —.
 = Jaden asked Olivia to help Jaden.

(56) $\lambda w.\lambda y.\lambda x.$ **help**(w,x,y)
 antecedent
 s – world
 e 1 pronoun
 e – argument
 ellipsis
 s – world
 e 2 pronoun
 e – argument

Effectively free pronouns and traces that are implicit in an ellipsis VP are free to choose whatever indices fit into the derivation. The choice is constrained by focus licensing of ellipsis. This is like Rooth (1992), except that the downstairs relation is model-theoretic anaphora, rather than syntactic reconstruction. This creates the potential for bound and covariant readings of VP ellipsis, when the antecedent is focused or is a higher-order Boolean.

(57) That toilet Op₁ he promised to [clean e_1]₂.
 This toilet Op₃ he REFUSED_F to $e_{2,seet}$.

(58) $\lambda w.\lambda y.\lambda x.$ **clean**(w,x,y)
 antecedent
 s – world
 e 1 trace
 e – argument
 ellipsis
 s – world
 e 3 trace
 e – argument

The semantics $\lambda w.\lambda y.\lambda x.$ **clean**(w,x,y) is identical across the occurrences, and so can be treated as copied semantically. The interface signature are isomorphic, modulo indices. Focus licensing is satisfied. The ellipsis relation has a semantic part (identity of semantic interpretation). It also has a syntactic part—identity of interface signatures, modulo indices. Or more generally, identity of interface signatures modulo vehicle change in the sense of Fiengo and May (1994) is identical across the occurrences, and so can be treated as copied semantically. The interface signature are isomorphic, modulo indices. Focus licensing is satisfied. The ellipsis relation has a semantic part (identity of semantic interpretation). It also has a syntactic part—identity of interface signatures, modulo indices. Or more generally, identity of interface signatures modulo vehicle change in the sense of Fiengo and May (1994).

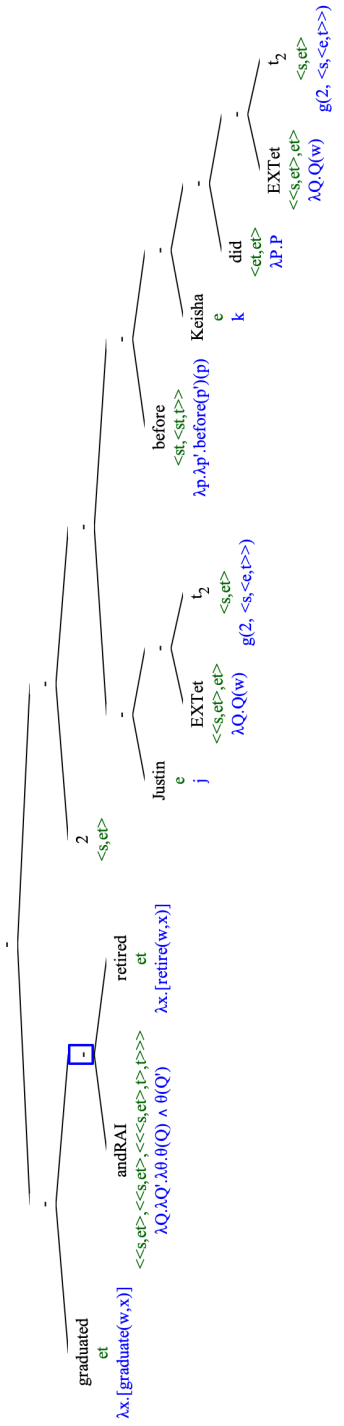
- (59) Justin₁ asked Amelia to help him₁ complete his project, and Jaden_{2,F} asked Olivia_F to do that.
- (60) THIS_F email Jack truculently refused to reply to. THAT_F email, he didn't do that.
- (61) Jack needed to find about a dozen books. I don't know which ones he MANAGED_F to.

At the outset, free-variable-free semantics was theoretically neutral. Any mainstream semantic account could be formulated this way, and doing so is a good idea, because it results in a compositional semantics that is logically and computationally straightforward.

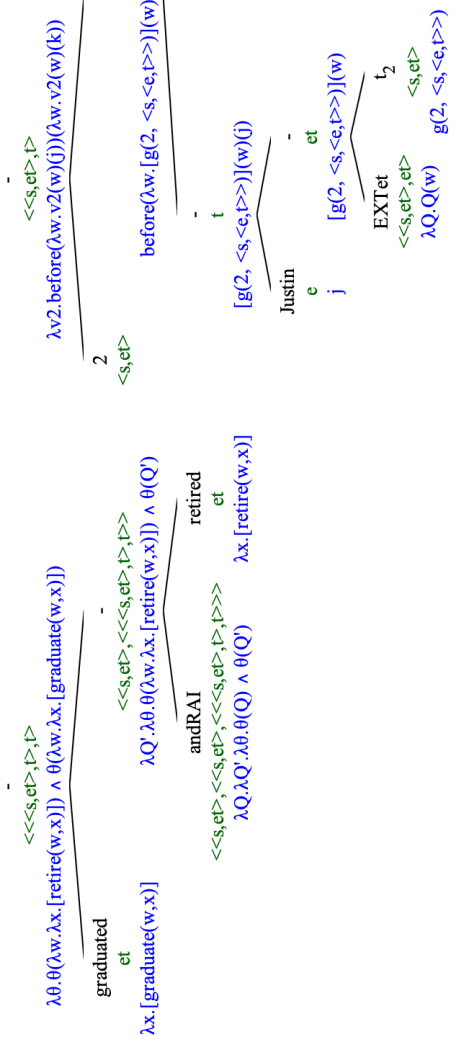
Once free-variable-free semantics is applied to ellipsis, it is *not* theoretically neutral. Anything in syntactic-semantic theory that exhibits connectivity in ellipsis—such as weak crossover or condition B—has to be formulated in terms of interface signatures rather than tree shapes, because in ellipsis examples there is no non-atomic tree shape in the ellipsis site. So there is really a lot to do in developing the analysis—Merchant catalogued thirteen varieties of connectivity. Thus the argument, if correct, has massive consequences for the architecture of grammar. However, these consequences agree with precise accounts of the minimalist syntax, and the semantics of minimalist syntax, where there is a finite amount of information—a list of features, or list of lists of features—that determine whether a given phrase fits into its syntactic context (Stabler, 1996; Collins and Stabler, 2016; Kobele, 2012).

Kubota and Levine (2020) – literature on free-variable-free ellipsis in categorial grammar.

(62)a. LF with scoped property quantifier



before(λw.retire(w,j)) ∧ before(λw.graduate(w,j))(λw.graduate(w,k))



b. Semantic derivation



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