Pauline Jacobson's Papers on Variable Free Semantics
Annotated (Partial) Bibliography
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This bibliography summarizes the range of phenomena covered - and arguments for - a variable free semantics as implemented specifically in Jacobson (1999) (*L&P,* **#5** below), augmented in some of the papers noted below, and revised (and improved on) in a few ways in Jacobson (2014) (*Compositional Semantics* OUP, #**15** below). The particular variable free approach that I have argued for is inspired by many earlier works that put forth the general idea of a variable-free semantics; I take no credit for the general idea. See, e.g., Quine's seminal paper "Variables Explained Away", and more linguistic-oriented work within Categorial Grammar by Szabolcsi in the late 1980s; this work played a seminal role in launching the general program. Also seminal was work in the 1980s by Steedman and Dowty - their work on extraction is a variable-free (trace free) account. See also Combinatory Logic, which is a variable-free system. Other authors also implemented the variable-free program in ways somewhat different from mine at around the same time I began work on this; see again Szabolsci, Hepple, Dowty and others. (All of this work is referred to in many of the papers listed below) And other authors (e.g., Barker and Shan) have since developed related systems. The goal here, though, is to show how the *particular* implementation worked out in a series of papers covers an interesting range of phenomena. It also goes without saying that there are many open questions (some noted below).

A second goal: I am also highlighting some subtle data which was new in the relevant papers - especially cases which have been discussed only minimally (if at all) in subsequent literature, but which I think are interesting and/or unexpected. I thus highlight these separately under **Interesting new fact**. *I will also put in italics discussion of problems and questions which were open at the time and/or which remain open, as well as followup developments/discussions.*

I do not include every paper relevant to this project. For one thing, I include only my own papers here - not because there is not a lot of important and relevant work by others - but just because I intend this as an annotated biblbiography of my work on this. Moreover, some of my papers on this are superseded by others and so not included here, and a number of other papers deal with more general topics - especially with Direct Compositionality and/or ellipsis more generally. While these interacts with the variable-free hypothesis, I'm including only papers in which the variable-free hypothesis plays a central role.

NOTATIONAL note: I should use indices to indicate the relevant readings. But I leave them out whenever the intended reading is obvious. BIBLIOGRAPHICAL note: Full references of other work referred to here can generally been traced from the bibliographies of the relevant papers; when not I've tried to include enough information to trace them.

Organization: I begin with the full annotated bibliography. This is followed by a brief summary of the apparatus involved and then a list of the phenomena accounted for.

All papers without links here are available on request.

**1. "Antecedent Contained Deletion in a Variable-Free Semantics", in *SALT 2 (1992).*
    pp. 193-213.**
http://journals.linguisticsociety.org/proceedings/index.php/SALT/article/view/3027/27
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   Background: Categorial Grammar (and earlier, Generalized Phrase Structure Grammar)
has shown that there is no need for a trace (and movement) in relative clauses like *every
newspaper that/which Katie read:* the subject can directly combine with the transitive verb
[[read]] (of type <e,<e,t>>) and does not need a full VP meaning (see, e.g., Steedman 1989).
With this background, the point of departure for the paper here is Cormack (1984), Jacobson
(1992 - in R. Levine (ed.) *Formal Grammar: Theory and Implementation,* Oxford University
Press) and others - who show that this allows an analysis of ACD cases like (1) with no need
for QR. ACD is analyzed just as an instance of "TVP" (transitive verb phrase) ellipsis - i.e.,
the 'missing' meaning (complement of *did*) in (1) is a two place relation (<e,<e,t.>), so (1)

(1)   Sarah read every newspaper that Katie also did.

The relevance of this to the more general variable-free program is that the TVP ellipsis
analysis by itself doesn't extend to Bouton's (1970) original cases of ACD as in (2):

(2)   Sally wrote to every boy who wanted her to.

But this paper shows that this is unproblematic in variable-free accounts of binding. (Note
also: there are other papers by myself and others on the TVP ellipsis analysis more
generally. Some show other cases of TVP ellipsis (Evans, 1988), and some show that the
basic analysis accounts for a number of other known facts about ACD including the Sag-
Williams generalization - see, e.g., Jacobson, 1992 - cited above.)

Interesting new (at the time) fact: The SALT 1992 paper also shows that this type of
'ellipsis' (involving a 'missing' 2-place relation) where the full paraphrase would contain a
pronoun (as in the Bouton case) is also possible across clauses (just like the situation for
ordinary VPE). The example here is changed to get rid of men kissing women; the
strikethrough material is meant just to indicate the relevant reading with no commitment to it
being 'silently' there at some level:

**(3)   Dad wants to tie the shoelaces of all of his kids. But only the youngest wants
        him to ~~tie her/his shoelaces~~.**

This type of example was subsequently (re)noticed in Merchant 2000   (*The Syntax of
Silence;* OUP Press) under the rubric rebinding.

Left open in this paper was how exactly to fold the 'ellipsis' analysis into the whole program;
how to treat the auxiliary, etc. This is worked out in detail in **9** below (Jacobson, 2003) and
in 2019 *Oxford Handbook of Ellipsis,* Temmerman and van Craenenbroeck (eds.)

*Followup debate -- The basic idea claim that ACD does not necessitate QR is challenged in
Hackl et al (2012 - Journal of Semantics). However, Gibson, et al (2014 - Journal of
Semantics; link below) and - with more theoretical detail as well as followup studies - in
Jacobson and Gibson (2014 - SALT 24 - link below) - show that the "Hackl effect" is due
simply to a heavy pressure to use also in certain cases, and has nothing to do with ellipsis.*

http://tedlab.mit.edu/tedlab_website/researchpapers/Gibson_Jacobson_et_al_2014_
Semantics.pdf

http://journals.linguisticsociety.org/proceedings/index.php/SALT/article/view/24.156/2149

2.   "Binding Connectivity in Copular Sentences", in *SALT 4 (2004)*.

http://journals.linguisticsociety.org/proceedings/index.php/SALT/article/view/2456/2204

   This paper considers prior arguments for ellipsis analyses of specificational sentences, including cases like (4) where it is assumed that *his* must be c-commanded by *every third grade boy* in order to be bound:

(4)   The woman who every third grade boy called was his mother.

It is shown that the analysis of (4) is smooth and automatic (without ellipsis) under the variable free and direct compositional program. *Background:* Groenendijk and Stokhof (*The Semantics of Questions and the Pragmatics of Answers*, IllC disssertation, 1983) and Engdahl (*Constituent Questions,* Reidel (SLAP series), 1986) give a semantics for functional questions, which I assume is basically correct. But in the 'standard' types of frameworks that they assume, something extra is needed to get these: the existence of functional readings is a surprise. However, it turns out that the functional readings of questions is automatic and requires nothing extra in the variable-free account of binding (combined with a Categorial Grammar account of Extraction). But that also extends to the case of functional NPs as in (4).   The only extra piece needed here is a rule allowing *woman* to shift its meaning to denote a set of functions with range women. (See also Sharvit 1997 in *L&P* who gives a similar analysis in the variableful setting. This shows that the basic idea is not necessarily tied in to the variable-free program but - modulo the shift of the head noun - which both theories need - the functional readings come for free   the variable-free analysis.) This then removes one of the major arguments that have been used for an 'ellipsis' analysis for specificational sentences.

   The fact that *his mother* denotes a function (and hence is appropriate in this type of specificational sentence) is also automatic here. The variable-ful analogue needs something extra for that. See, for example Gawron and Peters (*Anaphora and Quantification in Situation Semantics,* CSLI, 1990 in the context of short answers to functional questions). Note that the fact that *his mother* is an appropriate short answer to a functional question is also part and parcel of the same point. The relationship between specificational sentences and question/answer pairs has often been noted (Ross, 1989, Schlenker, 2003).   For discussion of how the variable free account allows non-elliptical treatments of short answers, see my paper on short answers in *Language,* 2016. Indeed, this paper argues that short answer do not involve ellipsis.   https://muse.jhu.edu/article/619541/pdf

Big Open issue: "Heycock's problem". Carolyn Heycock (personal communication) noted that a problem with the analysis here is that it should allow things like "The woman who he called is his mother" on a reading where what is being equated is two functions (so this would have the same reading as (4)).   But this doesn't have that reading. Some speculation regarding a solution to this is given Jacobson (2019) (16 below).   While this is not a full solution,, I note there that this problem will arise in any account that uses a functional type analysis for the relevant relative clauses (and questions) and so is not unique to the variable-free implementation.

3. "The Locality of Interpretation: The Case of Binding and Coordination",
  SALT 6 (1996).
http://journals.linguisticsociety.org/proceedings/index.php/SALT/article/view/2771/2511

   Big picture point: the view of 'binding' in this type of variable-free semantics makes the binding effect totally local (building into a shift on the verb) and is part of a more general program to have all of interpretation proceed entirely locally. That in itself is in the service of a direct compositional architecture for the grammar, and is compatible with a view in which there is no use of representations like LF and no constraints stated on chunks of representation. (More discussion of this point is found in many others of the papers below, but see especially **11** below on Principle B effects.)

   Data points of interest: this focuses on 'across the board binding' in ATB 'extraction' cases (e.g., Right Node Raising):

(5)   Every man loves but no man wants to marry his mother.

The possibility of this kind of "ATB binding' follows automatically from the variable-free view; *every man* function composes with **z**-loves. Ditto for *no man* and "**z**-wants to marry'. Each conjunct thus denotes a set of functions; they intersect, and 'the-mother-of' function is in that intersection. (This is completely analogous to the case of functional questions.) So nothing extra is needed for this kind of binding.

   The paper compares this in some detail to two alternatives making use of variables. One is an analysis of Right Node Raising where *his mother* occurs in both clauses at the level of interpretation. The other makes use of complex (functional) traces in each of the conjuncts. (It turns out that the latter had actually been proposed earlier in unpublished work by von Stechow and again later by Munn (*Natural Language Semantic)*. See the references in **5**. But these both overgenerate possible readings. For example one needs to make sure that the pronoun (or argument of the functional trace) is not bound in one clause and free in the other.

Interesting new fact: Although readings are not allowed with a mix of bound and free pronouns (which falls out in this account), the account here does predict that it should be possible to mix a case that wants a nested binding pattern with a case that wants a crossed binding pattern. (One can imagine ways to save the analyses above with variables, but ways that I can imagine which would save these predict that one should not get this kind of mixed binding pattern.) The reason that such readings are expected in the account here is that the semantic types of the two conjuncts will be the same regardless of their expected 'binding' patterns. And it turns out that this is allowed:

 (6) Every man$_i$ told his son$_j$ but no boy$_k$ wanted to hear his father$_h$ say that he$_{i/h}$ would withhold his$_{j/k}$ allowance.

 4. "Antecedent Contained Deletion and Pied-Piping: Evidence for a Variable-Free Semantics"; in *SALT 8 (1998).*
http://journals.linguisticsociety.org/proceedings/index.php/SALT/article/view/2800/2540

   Two punchlines. (i) The semantics of Pied Piping in relatives (and questions) gives no evidence for 'reconstruction'. For Pied Piping semantics (as in (7)) is straightfoward provided one treats a relative pronoun as a pronoun (big surprise!). (Sharvit, 1997 - *NELS*

- came up earlier with a very similar analysis, although hers is not set in the variable-free program).   The gap after *vote for* can be a functional gap, 'passed up' by **g** and then combine at the top with *the mother of whom* which is (like *his mother)* a function of type <e,e>.

(7)   the man the mother of whom Tom voted for

Interesting new fact - second punchline: (ii) There is an analysis of ellipsis discussed in, e.g. Heim (1997) (SALT 7) which is intended to account for "Kennedy's puzzle" about certain places where ACD is not allowed (see discussion below under items **10**, **12**, and **17**). However, nothing in that analysis (nor in other 'standard' analyses of ACD) accounts for the following contrasts (which were checked with 8 informants); so the second punchline centers on the following (new, as far as I know) contrasts:

(8)   a. ??Every candidate the father of whom BILL had ~~voted for~~, SUE voted for.
**   b. *Every candidate the father of whom BILL had voted for, SUE did ~~vote for~~.**

(8a) is good on the understanding where Sue voted all of the candidates who are such that Bill had voted for their father. (It helps to add some context - not done in the paper for space reasons - but easy enough to supply: let Bill be of an earlier generation than Sue, and let it be the case that there are many family dynasty candidate pairs.) But (8b) cannot have that understanding. Note that the corresponding case without 'ellipsis' is good on this understanding.   (I use 'ellipsis' here as a descriptive term only, and the strike throughs are meant just to show the relevant understanding.)

   I know of no obvious way to account for this in standard views of ellipsis and Pied Piping - even when supplemented by, e.g., Rooth's focus condition.   It turns out, however that this asymmetry is an immediate consequence of the variable-free account of Pied Piping (and 'ellipsis' understanding) combined with some version of Rooth's focus condition. (In this paper, I adopted a fairly standard view of this condition; but see **17** below for comments on how it ultimately should - or should not - be understood.) Thus the contrasts in (8) provides new support for the variable-free hypothesis.

   Open problem (pointed out to me by Danny Fox): Pronouns can be contrastively stressed; see for instance discussion of this in various papers by Sauerland and in 7 below. But relative pronouns don't allow this (at least not in similar cases) - a fact which is surprising if these are basically pronouns! I still have no answer for this, but can note that any other account of relative pronouns as 'pronouns' will have the same problem.

5. "Towards a Variable Free Semantics", *Linguistics and Philosophy,*   **1999.** https://link.springer.com/article/10.1023/A:1005464228727

   This paper gives the full details for implementing the basic idea of a variable free semantics, including discussion of various cases with more than one pronoun (with the sme binder, with different binders, with crossed or nested binding patterns, etc.) Some revisions - and improvements - to the mechanics are made in **15** below (2014 textbook). Some of the motivation for this are drawn from previous SALT papers and some of the arguments are new here. I discuss the account of functional questions (the functional readings are automatic), the answers to functional questions (also automatic that they are of the right type), some 'unexpected inferences' discussed earlier in work by Chierchia, and the RNR cases from 1996 SALT paper. The paper also discusses how Weak Crossover is folded into the system and shows this accounts for some known (and some new) interactions of WCO with functional questions (noted originally in May, 1985; the fact that these reduce to WCO

in a functional question analysis was first discussed in Engdahl, 1989 (see citation in **6**) below and later in Chierchia, 1991.

6. "Paycheck pronouns, Bach-Peters sentences, and i-within-i effects in a variable-free semantics", *Natural Language and Linguistic Theory*, 2000.

https://link.springer.com/article/10.1023%2FA%3A1026517717879

   A companion to the *L&P* paper with a number of additional empirical payoffs: the existence of 'paycheck' readings for pronouns comes for free (no need for extra meanings for pronouns); the fact that these can be arbitrarily complex (noted in earlier work by Engdahl and Cooper) is also automatic. Moreover, it is automatic that the gender feature of a paycheck pronoun is as it is (in a Cooper/Engdahl style version, it did not need to turn out the way it does.)

   To my mind, one of the nicest consequences to variable free semantics as married to a Categorial Grammar syntax is that i-within-i effects follow immediately and without stipulation (from an independent fact about the syntax of nouns and relational nouns).   I also discuss in this paper some interactions of paycheck pronouns with both WCO and with i-within-i effects that were noted originally in my (1977) dissertation (and which I mistakenly took there to argue for an ellipsis style account of paycheck pronouns). These are accounted for here without ellipsis.

The interesting old facts (from my dissertation):   (9) shows the WCO interaction; (10) the i-within-i interaction; (11) is an even worse case (also discussed originally in Jacobson 1977 - subsequently discussed in Higginbotham and May (1981 - GLOW proceedings)). The fact that (11) is even worse than (9b) and (10b) is also unsurprising (this was noted already in my dissertation); details are in both the *NALS* paper and the dissertation:

(9)   a. The woman who loves him (the most) calls her son every day (at lunchtime)
      b. *The woman who he loves (the most) calls her son every day (at lunchtime)
               compare   (b) to (c); (c) is the meaning (b) is trying to have:
      c. The woman who is loved (the most) by him calls her every day *at lunchtime)

(10)   a. The woman who loves him (the most) calls her sun every day (at lunchtime)
      b. *Her son calls the woman who loves him (the most) every day (at lunchtime)

(11)   *His wife called her childhood sweetheart.
         (NB: Higginbotham and May (1981 - GLOW Proceedings) changed the example
         to *His wife called her husband* which is an unfortunate change - since that
         sentence can be ruled out purely on fairly obvious pragmatic grounds - see the
         NALS paper for discussion.)

Interesting new fact: i-within-i effects are sometimes ameliorated for some speakers with transparent agentive nominals. This fact is also not surprising under analysis here, since (12a) involves a productive mapping from transitive verb to agentive relational noun and so for some speakers presumably can apply to an input verb which has already been mapped to the 'binding' version by **z**. Relational nouns like (12b) are presumably listed in the lexicon and so behave like all other relational nouns; the explanation for why ordinary lexical relational nouns don't allow this 'binding' (giving rise to i-within-i violations) is documented in the paper. Hence there is a robust contrast in the following (the ?? notation is a 'split the difference' notation - some people like these just fine, others don't - but for everyone the contrast is pretty striking):

**(12) a. ??The lover of his mothers' art collection will get to inherit it.
      b. *The lover of his mothers' best friend will find some good photos**.

7.   "Paychecks and Stress" in *SALT 10 (2000)*.
http://journals.linguisticsociety.org/proceedings/index.php/SALT/article/view/3103/2826

Point of departure: Sauerland (1998) uses the fact that pronouns can be focused in something like (10) to argue for indices (the indices contrast):

(13)   Every fourth grade boy$_i$ called his mother, but no FIFTH grade boy called HIS$_j$
      mother.

But even in Sauerland's work, he noted that it's not a simple matter of the indices contrasting, since this is not good if the binders are different but are the same domain:

(14) *Every fourth grade boy$_i$ loves his mother, but no fourth grade boy$_j$ actually
      CALLED HIS$_j$ mother.

My SALT paper tried to account for where focus (or, contrastive stress) is allowed by treating pronouns as identity functions *on different domains*. Hence a domain restriction can be incorporated in to give the contrastive focus.

Interesting new fact 1: More interestingly, I was concerned with the fact that *paycheck pronouns* do not always allow this and shows that this follows from the basic account in this paper combined with the account of paycheck pronouns in my other work:

(**15) *Every fourth grade boy$_i$ called his mother, but no FIFTH grade boy$_j$ called HER.
      (contrast *HER to good: *HIS mother*, and good *her* - without stress)**

Interesting new fact 2:   I claimed that pronouns can get this kind of stress in two ways: (a) the domains can contrast (hence, identity functions on different domains), or (b) a pronoun can be a function from an individual to self with the contrast being that the function maps that individual to someone else. One can thus see this in (13) where (13a) involves a contrast in domains and (13b) the contrast is between the mapping from an individual to self vs. to others - both expressible in the general framework here though details of the combinatorics were not spelled out (see below):

(16)   a. Every third grade boy$_j$ loves his$_j$ mother, and every fourth grade boy$_j$ loves HIS$_j$
      mother.

      b. Every third grad boy loves Jack's mother, and every fourth grade boy$_j$ loves HIS$_j$
      mother.

The interesting fact is that reflexive pronouns show two different stress patterns -
      correlating with these two different readings!

**(17) a. Every third grade boy$_i$ voted himself$_i$ and every fourth grade boy$_j$ voted for
      HIMself$_j$. (this the different domains contrast)**

      **b. Every third grade boy$_i$ voted for his$_i$ mother, and every fourth grade boy$_j$
      voted for himSELF$_j$.**

(contrast is that the individual mapped to self contrasts with that individual mapped to someone else)

I am not aware of any subsequent discussion of this two types of contrasts in pronouns and the interesting facts that we get this different patterns in the reflexive.

Open question: I had and still have no account for why the particular stress pattern on the two reflexives is the way it is. Would love to hear ideas on this!!!! And what happens in languages with long distance multimorphemic reflexives?

Followup: This brings up the point that one really wants to fold in the treatment of focus in a VFS. Later this was done in a very elegant way in a Brown University Honors Dissertation by Jackson Golden, Compositional Semantics of Focused Pronouns in a Variable-Free Semantics, Brown University, 2014. He never published this, but it is available on request.

Big Open Questions: The analysis does require assumption about domain restriction, some of which seem problematic. Some of this discussed by Dimitriadis who has a nice reply in a later SALT 11 (2001) - I have only a promissory note at this point that his objections can perhaps be overcome. There was more back and forth about this idea in stuff of Sauerland (2008) - paper the K Johnson (ed.) Topics in Ellipsis (2008, Cambridge University Press). There Sauerland proposes a similar (though not identical) idea; see his paper and see long footnote in my paper in the same volume for reply.

8. **"Direct Compositionality and Variable Free Semantics: The Case of Binding Into Heads" in *SALT 12 (2002*).**
http://journals.linguisticsociety.org/proceedings/index.php/SALT/article/view/2862/2602

Unfortunately, the apparatus discussed in the all of the above papers for 'binding effects' does not automatically account for the 'binding into a head' effect shown in (18) ; these are often accounted for (in the standard view of binding) by an analysis involving (a) head raising in relative clauses, and (b) reconstruction of relative clauses into the gap or, instead (which seems to me to be preferable) by the copy theory of movement:

(18) a. The relative of his that every man admires the most is his mother.
      b. The man that she knows that no woman would hesitate to invite is her brother.

This paper shows that the addition of one more very simple and quite natural shift rule can get these. Note: while indeed something extra is needed, it is far from clear that this is less preferable than movement, copy theory and head raising. At the very least, the standard package of assumptions is incompatible with a direct compositional architecture which seems to me to be a simpler architecture; see discussion in, e.g., **16** below, but also in an *L&P* paper in 2002., and also in the following:
http://web.eecs.umich.edu/~rthomaso/lpw04/jacobson.pdf
 And, while this does require something extra, it is shown that the standard account - via reconstruction - is actually problematic on empirical grounds. (See also **16** and the paper linked to above.)   The reason has to do with stacked relative cases, like (19a) and (19b):

(19)   a. the paper that he handed in that every boy was most proud of
       b. the paper which/that every boy handed in that he was most proud of

Interesting new fact: A reconstruction analysis (with head raising) can handle (19a) but not (19b). There is, however, a potential fix - maybe (19b) involves an extraposed relative (see the full paper for details) while (19a) involves ordinary stacking. Fine, but this then won't do any good for (20) where there is binding from each relative clause into the other (let all the students be male and all the phonology professors female)

(20)   The paper that every student handed in to her that every phonology professor gave him an A on was the last one he wrote for her class.

    It turns out that the variable-free account does need a slight generalization of the 'binding into heads' rule so I cannot really claim that cases like (20) comes 'for for free'. But the generalization is fairly straightforward. On the other hand, it appears that there is no way to account for this kind of binding pattern under standard reconstruction/head raising accounts. This (with many other interactions with stacked relatives) is revisited in **16** below.

*Followups: (1) At the Relative Clause Reconstruction conference in Berlin in 2011, Irene Heim pointed out that the use of <u>every</u> in these weakens the argument; see the discussion in Jacobson (2019 - **16** below for why. There I recast the argument using <u>no</u> in both clauses to circumvent Heim's objection. Followup (2): Barker's paper in the Relative Clause Reconstruction volume (2019 - see below) brings up three challenges to this - some based on observations he attributes to Ken Shan. Two of these are answered in **16** below. The third is the one already noted abpve due originally to Carolyn Heycock; this remains a problem but - as noted there - is a problem for any analysis of these types of cases based on the functional analysis of, e.g., Groenendijk and Stokhof and Engdahl, and so is not a problem just for the variable-free account. Of course there are analyses of 'functional questions' and their related functional relatives which are quite different (see, e.g., Heim in the Relative Clause Reconstruction volume) which might avoid the 'Heycock problem'.*

9. "Binding without pronouns (and pronouns without binding)" in Kruiff and Oehrle (eds.), *Binding and Resource Sensitivity,* Kluwer (SLAP series), 2003.
prepublication version:
http://www.cog.brown.edu/People/jacobson/bind_wout_pros.pdf

    There are a number of variable-free proposals which implement the 'binding' effect in different ways; in particular Szablocsi 1991 (in the Szabolcsi and Sag (ed.) volume *Lexical Matters,* CSLI) and also Dowty, 1992) locate the 'binding' of a pronoun by the meaning of the pronoun itself.   The main point of this paper is to respond to that and point out advantages to the implementation in   my works via the **z** rule which locates the effect in a shift on the meaning of the function expression taking the pronoun-containing expression as argument. (The title says it all: there are binding effects with no pronoun present, and at the

same time, one does not want to have to treat free pronouns differently from 'bound' pronouns.)

This paper also outlines in full detail how to do the ACD <u>and other TVP Ellipsis cases</u> using only the general machinery needed in any case in the variable-free program. Quite crucially, we would not want "TVP Ellipsis" to involve something different from the mechanisms needed for "VP Ellipsis". After all they are one and the same in the 'standard' view; both involve ellipsis of VPs, its just that in the "TVP" cases its a VP with a trace or pronoun with it. But this paper showed that they are unified in this view too - they TVP Ellipsis cases are nothing more than the mechanism for 'missing VPs' extended by the use of the "Geach" rule - already in the program - and so their existence is automatic. (Further generalization of this is in Jacobson 2019 in Temmerman and van Craenenbroeck (eds.), *Oxford Handbook of Ellipsis,* Oxford University Press.) The paper thus discusses a number of cases which are among those that have gone under the rubric of 'rebinding'. Moreover, as is well known, VPE is possible with no overt antecedent, the prediction is that TVP ellipsis should also permit this; a case is given in this paper of that type. (A somewhat more natural case is constructed later in my SALT 29 paper **17,** so see below.)

Finally, in this paper I argue that VPE is 'deep anaphora' (something suggested in Hardt, 1993 - dissertation though his proposal is slightly different). Of course Hankamer and Sag (1976) already argued against this - but since then many counterexamples to Hankamer and Sag have emerged. But why were they almost right? In this paper, I suggest that the reason it is so much harder to get VPE with no overt antecedent than ordinary free individual pronouns has to do with type complexity: it is harder to 'access' out of the blue functions of type $<e,t>$ than individuals.

*Followup: The point immediately above about why VPE is hard to get without overt antecedents is pure speculation, but seems reasonable. This speculation forms the basis for the account of 'MaxElide' phenomenon discussed later in Jacobson (SALT 29 - **17** below) and also in Jacobson (to appear), <u>Proceedings of the Conference on Logic and Engineering of Natural Languzage Semantics **15**</u> (Yokohama), Springer Lecture Notes in Artificial Intelligence.*

10. "Kennedy's puzzle: What I'm named - or who I am?" in SALT 14 (2004).
http://journals.linguisticsociety.org/proceedings/index.php/SALT/article/view/2911/26 51

This paper addressed "Kennedy's puzzle" (see (21) below) - a solution to which was proposed in Heim (1997). Her solution crucially makes use of *variable names* - along with a principle (stipulation) of No Meaningless Coindexation. In this paper I argue that Heim's insight is basically correct but that it can be implemented without use of variable names. The Kennedy 'puzzle' is this: why is (21) bad (on the reading where the material in italics indicates the understood 'missing' meaning):

(21)   *I will vote for any Democrat who shares an office with someone who is running
         against the Republican that Lee plans to (*vote for).

NB: The usual cases given to show 'Kennedy's puzzle' are simpler (examples like *I will
vote for any Democrat who is running against the Repubican that Lee plans to) and involve
one less level of embedding. However, this type of case doesn't really make the point; it
could be ruled out in other ways - see paper for discussion.)

    My claim was that Heim was basically right that the votees in the matrix and the votees in
the lowest relative clause have no connection with each other (unlike in normal ACD), but
that this can be tracked not by the use of variable names but directly by the meanings
involved. The proposal in that paper was sketchy; it is worked out in much more detail in **12**
and **17** below.

Relevant (though not really surprising) fact:

  Heim's actual proposal - which involved the 'formulas hypothesis' incorrectly predict that
cases like (22) should be bad:

(221)   The Democrat that Lee voted for is running against the Republican that Kim had.

These are discussed in Kennedy (SALT 24 - 2014) who refines Heim's proposal to allow
these in while still ruling out the bad cases. But Jacobson SALT 29 (2019 - **17**) shows that
Kennedy's solution still does not account for the full range of facts; it allows in certain bad
cases involving stacked relatives.

11. "Direct Compositionality and Variable Free Semantics: The case of 'Principle B'
      effects" in Barker and Jacobson (eds.) *Direct Compositionality,* Oxford, 2006.

    A common question about the variable-free program is: "how can it account for Principle
B effects"? (which are often assumed to require a constraint on co-indexation). This paper
(a) argues that constraints on indices actually can't account for the relevant range of data (so
the question really ought to be: how can a coindexing constraint account for 'Principle B
effects'?); and (b) proposes an account of these making no use of indices which accounts for
a much fuller range of facts than does Principle B. It is perfectly well-known that Principle
B itself - as a constraint against coindexation - is insufficient to account for the badness of
Bush praised him (on the relevant reading) because of the possibility of 'accidental
coreference'. (See, e.g., Grodzinsky and Reinhart, 1993). Enter Rule I, or Rule H or various
variants. I argue in this paper that these not only introduce additional complexity but that
any such principle is highly implausible on a variety of other grounds. Such principles have
to be stated as principles of the processor (the grammar itself cannot know about the
interpretation of a sentence once a value is supplied for a free pronoun), but such a principle
is entirely unprecedented in terms of what is known about processing. Moreover, it has to
rule out understandings on the basis of another possible derivation - but *that derivation itself
is blocked by Principle B!!!!* (A later account by Reinhart seeks to use the very fact that

these are ruled out by Principle B as crucial in the extra principle - but this account too relies on unprecedented machinery,) So it's an illusion to think that coindexation and constraints on indices provide an account of the facts.

   The solution here allows verbs to combine with pronominal objects only if they undergo a shift rule which removes the reflexive pairs from their denotation. This accounts for the violations in both 'bound' and 'accidental coreference' cases. (It has often been argued that the two should <u>not</u> be handled by a single mechanism - see, e.g., much child language acquisition literature beginning with Wexler and Chen - but the account here does predict that the violation in the 'bound' case should be stronger.)   All of this means we do not need constraints on global 'chunks of representation' (as is assumed in so-called "Binding Theory" statements like Principle B.

Open question: This takes care of the effect known as Principle B. But one still needs to account for the distribution of reflexives. I hope to address this in future work. Keenan, Szabolcsi and others have proposed treating the reflexive pronoun itself as an argument reducer - one problem with that is it will not extend to the 'long distance' cases where the reflexive is the complement of a relational noun such as a picture noun. (Such cases also go under the rubric of 'logophoric reflexives' in the literature, but it is not clear that this really lines up with the cases for which this term was originally intended by Clements, 1972.) This also leaves open how to account for so-called 'Principle C' effects. While I have no such account, 16 below shows that here too there is no real sturdy account making use of coindexation and constraints on representations (for much the same reason as the problems with doing this for Principle B). See also online ms. below for discussion of Principle C.
        http://web.eecs.umich.edu/~rthomaso/lpw04/jacobson.pdf

12.   "Do Representations Matter or Do Meanings Matter: The Case of Antecedent Containment", in E. Hinrichs and J. Nerbonne (eds.), *Theory and Evidence in Semantics: Studies in Honor of David R. Dowty,* **CSLI Publications (2008).**

   This is a followup (and more precise version of) my remarks in SALT 14 (**10**) to the effect that while Heim's basic explanation about "Kennedy's puzzle" is correct (in the bad cases, the two relative clauses are 'about' different things), this can be tracked directly in terms of the meanings, not the representations. Heim's account is representational, and makes crucial use of variable names. (In **17** below I argue that Heim's account - and similar ones - also rely on having an overt linguistic antecedent to supply the necessary ingredient for Rooth's focus condition to be met - but this cannot be correct in view of 'ellipsis' cases with no linguistic antecedent at all, nicluding TVP ellipsis.)

   What I take to be the main new and interesting contribution here is the observation that <u>exactly the same pattern is found with</u> *also* - modulo the fact that ellipsis just wants a contrasting <u>salient</u> proposition (or other meaning) whereas the presupposition of *also* is that there is an alternative <u>true</u> proposition. The key facts are as follows: (23) just repeats the Kennedy puzzle facts and (24) shows the same pattern with *also:*

(23) a.   I will vote for any Democrat that Lee does *(vote for)*
     b. *I will vote for any Democrat who shares an office with someone who is running against the Republican that Lee does (*vote for).*

(24) a.   I will vote for any Democrat that Lee also does.
     b. *I will vote for any Democrat who shares an office with someone who is running against the Republican that Lee also votes for.

> *Note:* Of course (24b) is not strictly speaking * - it is fine in a supportive context where something meets the presupposition that someone else votes for the relevant Republican; but out of context nothing supports that presupposition, so (24a) requires no extra context while (24b) is bad out of context. The same is true for the contrasts in (23) and any of the 'Kennedy' cases - they are all fine if something in the background context supports the contrast.

The two cases are, to be sure, not entirely parallel in that substitution *no* for *any* in (23a) preserves the goodness while in (24a) this would be bad . But that of course follows from the meaning of *also* - and hence from what it takes to satisfy the presupposition.

   The distribution of *also* is in some sense - hardly surprising.   But what is interesting here is that it involves an 'antecedent contained presupposition'. Leaving aside the details about the computation of the satisfaction of the presupposition (an interesting question!), we know that presuppositions are about <u>meanings</u>, not <u>representations</u>. (In fact the paper shows in great detail that we cannot try to recast the satisfaction of *also's* presupposition in representational terms; nor would we expect to be able to). But the parallel to the ACD case is striking: *also* requires a true salient alternative (i.e., some member of the focus value given a Roothian style computation of focus) while ACD just requires a salient alternative in the context, but neither should care about the representations.

   This paper thus gives a way to talk about the focus value of expressions containing pronouns or 'gaps' within them and shows how *also* can make use of these values. Since [[also]] can be thought of as acting on a proposition and a set of propositions (the focus value), it needs to shift in such a case, and does so by a generalization of the 'Geach' rule. This generalization turns out to have independent motivation - completely separate from the the issue of variable-free - and is developed in my textbook (**15**). It is shown that this technique also extends to something very loosely like Rooth's ~ operator, which needs to be present in 'ellipsis' cases. (See my SALT 29 (**17**) paper for further development of this.)

13.   "Direct Compositionality and Variable Free Semantics: The Case of Antecedent Contained Deletion", in K. Johnson (ed.), *Topics in Ellipsis,* Cambridge University Press, 2008.

   This paper is primarily about ellipsis and (as one can guess by the title) much of the material in there is contained in various forms in other papers referenced here. But the focus here is more on the theor comparison; it presents an in-depth comparison of the 'standard'

view of how semantic composition has to proceed in the 'standard' view, and the direct compositional/categorial grammar/variable free view. Thus this discusses the consequences of assuming some version of the theta-criterion and/or the projection principles: such assumptions (in various forms) go back to the earliest days of transformational grammar and have persisted in much modern work in 'standard' views. It is these - and/or their analogue in modern terms (e.g., a function must always be 'saturated') that gives rise to the view that ACD is a species of VP (not TVP) ellipsis. This in turn necessitates a trace in the 'antecedent of ACD (and hence QR). The paper details how a difference in the underlying assumptions about how semantic (and syntactic) composition proceeds gives a very different picture in the variable free/Categorial Grammar/direct compositional view.

*Followup: In this paper I asssumed a function composition analysis of extraction as in, e.g., Steedman (1989). In [**15**] I recast this into the two step process of the 'Geach' rule plus application. (See also Jacobson, 2019 in Temmerman and van Craenenbroeck, eds., <u>Oxford Handbook of Ellipsis,</u> OUP where a generalization of this leads us to expect the existence of pseudo-gapping.) The relevance of that to the remarks here is that in a function composition view a function can directly combine with an 'unsaturated' function. If broken down into these two steps, that is not quite what happens. But the basic point is the same: 'unsaturated' functions can map to more complex functions by the Geach rule without first combining with their arguments. This still then is different from the way things are generally assumed to work in much of the standard literature.*

14. "Direct compositionality and 'uninterpretability': The case of (sometimes) 'uninterpretable' features on pronouns'. *Journal of Semantics* 29.3, pp. 305-343, 2012.
https://academic.oup.com/jos/article/29/3/305/1721478

This paper addresses the fact that gender and person features in cases of 'bound pronouns' do not seem to play a role in the interpretation in cases like *'Only I called my mother'* (attributed originally to Partee and discussed in many places since) and *'Only Sally called her mother'* . (These both can be understood as making the claim no one else is a self's mother caller, regardless of the gender of the other potential mother-callers). Many have argued that these features are semantically inert because they are there only by agreement (Kratzer, 1998, 2008, von Stechow, 2003, and others). I argue here that these are not agreement features; they simply play no role in the focus value of an expression. This is also proposed in a variable-ful framework in Spathas 2007 and explored and rejected in Heim 2005 - so the basic idea for the simple cases is not crucially tied in to variable free semantics and hence not an argument for the variable free view.

But the 'punchline' concerns the interaction of these features with paycheck pronouns. First, the agreement solution cannot handle the paycheck facts below in (24) and (25), while the proposal here - combined with the account of paycheck pronouns in, e.g., Jacobson (2000) (**6** above) does account for these (supplemented by one small technical addition to allow a function whose domain itself is a set of functions to apply to partial functions).

Interesting (and key) new facts:

   The same insensitivity to these features in the focus value holds <u>for the case of paycheck pronouns</u>. For the gender feature: Suppose that the Linguistics Department at the University of Antarctica has a number of faculty members each of whom has a spouse, and suppose further that some spouses are females and some males. It happens that Bill's spouse is a female. (25) is good and says that no one but Bill brought their spouse (regardless of the spouse's gender)

(25)   For the departmental Christmas party, every faculty member was encouraged to bring their/his or her spouse. But only BILL brought her.

For the person feature case (spoken by someone whose spouse is Michael):

(26)   Some people feel that they should do more work than their spouse. Some people feel they should do less work than their spouse. Only MICHAEL   thinks we should do the same amount of work.

(This is reminiscent of cases discussed in Rullman 2004, 2008 except that his do not involve paycheck pronouns.)

   Whether the analysis here can be translated into a variable-ful treatment is not explored in the paper, but we can note here that it relies on the treatment of the gender feature on a paycheck pronoun discussed in Jacobson (2000, [**6**], where I show that the gender is not automatic in a variable-ful type analysis such as the Cooper/Engdahl analysis. It is also not obvious how an ellipsis analysis will get the full range of facts. Thus it is noteworthy that the variable free analysis of paycheck pronouns (and their gender feature) combined with the proposal that 'phi-features' are inert in the focus value accounts for the paycheck facts above.

Open question: The paper also points out that we do not get this phenomenon with first person singular pronouns. For example, imagine (24) spoken by someone whose spouse is named Michael, that person cannot (on the paycheck reading) say: "*But only MICHAEL brought me". This is analogous to the <u>good</u> case with first person plural. I have no solution for why this difference.

15. *Compositional Semantics: An Introduction to the Syntax/Semantics Interface.*
      Oxford University Press, 2014.   In particular, Chapters 15 and 17.
https://global.oup.com/academic/product/compositional-semantics-9780199677153?lang=en&cc=us

   This is a textbook, and so not primarily concerned with variable-free semantics; it is not even only concerned with Direct Compositionality, although much of the material is presented in a direct compositional (and Categorial Grammar) framework. However, it also contains a presentation of the material from the point of view of a theory with Logical Form, and provides comparison of the two. (Hence, those instructors who want their students to

learn the 'standard' LF view can use this book as a text; it is designed to be somewhat eclectic, even though it does promote a certain approach.) The relevance to variable-free semantics, however, is that it does, in the two chapters above, (a) presents a fairly detailed comparison to the direct compositional/variable-free approach to a 'standard' approach with LF and variables (b) it improves on some of the technical details in Jacobson (1999) and motivates some of those details more generally; and (c) provides some new material in Chapter 17.

   In particular, consider a case of two 'co-bound' pronouns as in *Every 3d grade boy$_i$ thought that the woman he$_i$ met in the park would love his$_i$ dog.* In Jacobson (1999 [**5**]) this reading arose from two applications of **z** on *think.* While this derivation is possible (and has a nice benefit to be documented in future work in terms of so-called "Weakest Crossover"), the revised/expanded system allows for a simpler derivation two. Basically, the "Geach" rule (**g**) is given in a more general form such that, for example, a function of type <a,<b,c>> can map to one of type <<d,a,>,<<d,b>,<d,c>>> - informally, any number of 'argument slots' can be opened up. Application of this to *love* above allows the two pronouns to 'know' they are the same at the level of the embedded S. The generalized Geach rule is motivated entirely independently of the variable-free program; for example it allows a single *and* to be listed in the lexicon (as sentential *and)* where all others are derived from this by this generalized Geach rule. Jacobson (1999, [**5**]) also proposed stating the 'Geach' rule recusively; in the fragment developed in the textbook *all* the rules are stated recursively which has several advantages.

     On the empirical side, Chapter 17 extends the analysis of functional questions, paycheck pronouns etc. to cases of 'complex variables' (in the standard terminology) that have been noted in various places in the literature. For example, von Fintel (1994) noted that domain restrictions can be complex, as in *Every professor thought that no senior would pass* (where 'no senior' is interpreted as the seniors in the relevant professor's class). In standard terms, then, the domain restriction 'variable' can be represented as F(x) where x is bound (in this case by *every senior)* and F remains free and is interpreted as the function mapping each professor to the set of students in their class. But this type of 'complex variable' case comes for free from the variable free apparatus (just as does the complex case of functional questions). Similar remarks hold for comparison classes (as in *All of John's children are tall,* noticed in Kennedy 1997). More generally this chapter notes what I called the 'paycheck generalization': Using standard terms, wherever there can be a 'variable' there can be an arbitrarily complex variable (a la Engdahl/Cooper treatment of paycheck pronouns and functional questions). In variable-free terms, this translates as follows: any open argument slot of type X can also be one of type <e,X>. This generalization emerges automatically from the variable-free apparatus; the more complex types just involve applications of **z** or **g.**

16. Decnstructing Reconstruction in M. Krifka and M. Schenner (eds.), *Reconstruction Effects in Relative Clauses,* De Gruyter Press, 2019.

   This paper returns to the case of 'binding into heads' which is often taken to provide evidence for a reconstruction analysis of relative clauses. I argue that not only can this be

done without this (and purely direct compositionally) using the apparatus developed above and in particular in **8** above (SALT 12), but that the interaction of this phenomenon with, e.g., stacking provides difficulties for a reconstruction analysis which are avoided in the variable free treatment (see (26) below). I also discuss the interaction of Pied Piping with functional readings. (There is also more general discussion - independent of binding issues - of why the 'evidence' for reconstruction does not really go through, including discussion of so-called Principle C effects, idioms, and the cases discussed originally in Bhatt 2002).

   Interesting new facts Crucial cases which seem to pose problems for reconstruction treatments include the following (which is an elaborated version of a case first discussed in Groenendijk and Stokhof 1983):

(27) **Every third grade boy invited the (very) relative of his that no fourth grade boy would dream to invite - namely his mother.**

A similar case with stacking is (28):

(28)   **The relative of his that every third grade boy invited that no fourth grade boy would be caught dead inviting is his mother.**

Details of why these pose problems for reconstruction accounts are spelled out in the paper.

17. Why we still don't need/want variables: Two SALTy case studies, to appear in Proceedings of SALT 29, 2019. (handout available on request)

   This paper considers two proposals (appearing in SALT proceedings) which would seem to show the necessity for variable names (and No Meaningless Coindexation). Both center on what I am calling 'TVP ellipsis', and both can actually be accounted for in the variable free framework. Not only are variables not needed, but the second of these turns out to be a new argument *for* the variable free hypothesis. In particular, the variable-free hypothesis leads to the analysis of certain 'ellipsis' cases as involving missing meanings of type <e,<e,t>> (the TVP Ellipsis analysis), and this provides a more natural account (also with an empirical advantage) of the relevant phenomenon.

   The first case study here is the one from Heim 1997 discussed above - this attempts to use variable names (combined with a No Meaningless Coindexation) to account for 'Kennedy's puzzle'. The basic idea was sketched already in **10** and **12** above, but is refined here. (This paper also answers a revision of Heim's proposal given in Kennedy, *SALT 24,* 2014, though published in *The Art and Craft of Semantics* (Heim festschrift), 2014.). In addition to this refinement, this paper stresses a crucial point: most accounts of something along the lines of Rooth's focus condition on ellipsis (as well as its application to the Kennedy puzzle) assumes that ellipsis requires that there is an <u>overt linguistic expression</u> C_{ANT} whose meaning is a member of the focus value of some constituent C_{ELL} which contains the ellipsis site. In the first place, this is much stronger than what Rooth actually proposed. But leaving Rooth himself aside, this account cannot possibly be right since we know that VP (and TVP)

ellipsis requires no overt antecedent whatsoever. This paper provides new data for the TVP ellipsis case (clearer than the relevant data in some of the earlier papers). See (29) below.

  The second case discussed here is an analysis of Takahashi and Fox (2005) of some facts noted first in Sag (1976). Sag noticed certain cases of embedded ellipsis sites which do not support sloppy identity.   Since then, however, it has been shown that Sag's particular generalization cannot be correct since there are good cases of the same general sort (see, e.g., Evans, 1988 and Jacobson, 1992 (**1**) above).   Takahashi and Fox argue thus tackle the question of why the contrast between the good cases (Evans/Jacobson) and the bad cases (Sag). Their proposal: these are due to the fact that in the bad case, there is competition with an available higher ellipsis - and so they relate this to the MaxElide condition proposed originally in Merchant (2000). MaxElide says that when there is a competition between a larger ellipsis and a smaller ellipsis, only the larger ellipsis is allowed. But it is more complex than that: <u>T&F point out that this holds *only* when the smaller possible ellipsis contains within it an unbound trace or variable</u>. They attempt to hook this into Rooth's focus condition (restated by them) combined with No Meaningless Coindexation.

  In the end, however, their account rests on MaxElide which is an stipulation within the grammar - one which does not seem to have any independent motivation. Moreover, it makes sense to think that competition effects should ultimately be rooted in choices of speakers and hearers and not encoded in the grammar. (Even if one is happy enough with 'economy driven' competition effects as part of the grammar, this particular effect has nothing to do with economy.) I argue here that T&F are correct that the relevant contrasts are indeed due to competition effects. BUT the competition has nothing to do with size - but rather with *types*. Given the variable-free apparatus, the bad cases are all cases where an $<e,<e,t>>$ ellipsis competes with an $<e,t>$ ellipsis. I do not assume that 'ellipsis' involves actual silent linguistic material- but merely something missing. Hence, the bad cases are ones where the listener must recover a 2-place relation; the competing good cases are ones where only a missing $<e,t>$ must be recovered. Given the speculation in earlier papers that more complex types are more difficult to recover, this competition principle can realistically be seen as a principle based in communicative pressures, not a stipulation in the grammar. Note, though, that this account is available only under the assumptions of the variable-free program which allows for the "TVP Ellipsis" account. It is also shown that there are cases distinguishing the two accounts (size vs. type competition), where only the type competition account makes the right predictions.

Interesting new(ish) fact: Illustration of "TVP Ellipsis" with no prior linguistic antecedent.

(29) Context: Dad with two kids: Keela and Zack. Keela (the older) has been trying to tell Dad for quite a while now that she is very independent, and doesn't need any help tying her shoes! But Dad is a creature of habit - and so he reaches down to start helping Keela - who says:

  (a)   Dad. Please! Stop! I DON'T WANT you to!!!

       Dad then reaches over to help Zack. But Zack likes to copy Keela, so he says
  (b)   And I don't want you to either!!! (though I don't care if you tie Keela's laces)

One can even follow this with three more kids, the oldest of which says:

(c)   Dad, none of us want you to!

There are a variety of ways to put together the relevant understanding of Keela's utterance, but anyway it is done entails ii) I don't **z**-want [you [*tie-shoelaces of]* =
   not (I am an x such that x wants you tie shoelaces of x)
Zack's utterance supplies the 'missing' 2-place relation *tie-shoelaces-of;* that needed to be the understanding in order to support *either* in his utterance. Note that (c) shows it must involve a bound reading.

Summary

The notation [**n**] below refers to the number given to the publication in the annotated bibliography above. (n) refers to the example sentences above.

I. The Apparatus involved

A. Basic apparatus that does most of the work (full details of syntax given in papers above)

NOTE: a full fragment - building on the fragment in Jacobson (2014) ([15]) will be spelled out in detail in forthcoming book on the whole program.

- pronouns as identity functions over individuals
     hence, e.g., single pronoun *she* in lexicon (no indices)

- "Geach" rule **g**   (spelled out in various papers, see especially [**15**])

   Semantics: in basic form: maps a function in <a,b> to a function in <<c,a>,<c,b>> :
   Let f be a function in <a,b>. Then **g**(f) - $\lambda X_{<c,a>}[\lambda C_c[f(X(C))]]$
        NOTE; this is a unary version of function composition:
           g(f)(h) = f o h
                (however, the analogue doesn't hold for the generalized version)

   Informal intuition: allows a function that wants an a-type thing as argument to combine
        with a 'wannabe' or 'incomplete' a, and passes up the incompleteness

   Syntax: (in brief) - coupled with a syntax which:
     (a) passes up (as a type of feature) information that an expression contains a pronoun
        which is 'unbound' within it, and
     (b) This also used for expressions which contain the analogue of 'gaps' (missing
        arguments) or 'traces' in the standard view.

   Therefore, in addition to its role for pronouns, this plays a role in the analysis of
        'extraction' constructions. See Jacobson (2014) [**15**] above.

This generalized in two ways:
>   a. Defined recursively. **Jacobson (2014 - textbook**) motivates having all combinatory rules defined recursively, independent of variable free semantics.
>   b. Allows any number of argument slots to be 'opened up', e.g.,
>   <a,<b,c>> can map to <<d,a>,<<d,b>,<d,c>>>
>   Jacobson (2014 - textbook) motivates this independently. For example, this allows for a single item *and* to be listed in the lexicon as sentential *and*, and map to all more complex types this way, rather than being listed as 'polymorphic', which is arguably a bit of a mysterious notion.

• "Binding": **z**- rule: (simplified here): maps a function of type <a,<e,b>> to one of type <<e,a>,<e,b>>
'merging' the two e-positions.   Formally: let f be a function in <a,<e,b>>.
  Then **z**(f) = $\lambda X_{<e,a>}[\lambda x[f(X)(x)]]$.
        Example: *to z-love f is to be an x who loves f(x).*

This generalized for the case of 3-place verbs.

Comment by way of comparison to 'standard' view:

*Everyone needs something extra for binding Standard view uses variables with indices (and hence assignment functios); the 'binding' step is the semantics of lambda-abstraction (rather than the semantics of **z**).*

• Focus computation: Compositional details worked out in Jackson Golden (see **7** above)
  Basic idea: take, e.g., : *MARY loves him.*

  At the level at which focus is interpreted (i.e., the constituent for which there is a salient contrast in the context, of where a focus sensitive word such as *only, also* etc. has scope): this is a function from individuals to a set of alternative propositions about someone loving them.

B.   Additional mechanisms with less general applications

• Rule allowing "binding into heads" (see [**8**]).

   Informally: this takes a two place relation (type <e,<e,t>>) and maps it into a set of functions of type <<e,e>,t>. The mapping is the minimal and obvious way to do this. Let R be of type <e,<e,t>>. "DeCurry" it - to give an ordinary two place relation (i.e., a set of ordered pairs). Collect up all subsets which are (partial) functions. This gives what is needed.

Comparison to 'standard' account with variables This an extra rule. But it also obviates the need for 'reconstruction' for the relevant cases. (Of course 'reconstruction' supposedly accounts for many other facts. For critique of the reconstruction solutions and problems with that account, see [**16**].)

• Need z generalization of the rule to account for cases like (20) above; see details in [**8**]

   Open question: The generalization does not have the obvious 'naturalness' as does the rule for the simple case above.

<u>Comparison to account with variables</u>: Need this extra generalization. However it is not clear how the standard account (using reconstruction as a way to meet the standard way that 'binding' takes place) can provide any account of cases like (20) without additional machinery.

NOTE: (20) itself uses *every;* see discussion referred to above. But **16** revises to use *no* as both determiners, making it difficult to see any possible account of this type of case using reconstruction.

• Notion of 'contracted' functional application in **14** above (to account for paycheck pronouns with features that play no role in the focus value)

• Account of Principle B effects in **11** above requires a rule shifting the ordinary 2-place relation meaning ($<e,<e,t>>$) of a transitive verb to one which removes the reflexive pairs from the denotation. The syntax is such that a pronoun in object position can combine only with the shifted verb.
<u>Comment by way of comparison to 'standard' account</u>: This takes the place of something like Principle B which itself does not account for the full set of data, and so usually supplemented by something like Rule I or some variant thereof. For detailed critique of the Principle B + Rule I strategy, see **11** above.

• Need a rule to shift head nouns such as *woman* into a set of functions with range *woman*.

<u>Comparison to 'standard' account</u>: Full comparison will not be done here as it depends on certain assumptions about the syntax of nouns themselves. Suffice it to say that certain functional accounts in the 'standard' (variable-ful) view also make use of this rule.

II. <u>The phenomena accounted for (partial).</u>

After each case, I list one or two of the papers in which these are discussed (some can be found in multiple places).

<u>First group</u>: These are phenomena which come 'for free' from only the basic apparatus (**g** and **z** plus the one shift listed last above, needed for functional relative clauses and probably also for functional questions).

Most of these, on the other hand, are a surprise under the standard view of pronouns, traces, etc. and require some extra assumptions. That said, several of these fall under what I called the 'paycheck generalization' in [**15**]. This generalization is: Wherever in the standard view the semantics of some expression includes a variable of type X, it can instead be also a 'complex variable' (in standard terms, a variable of type $<A,X>$ applied to a variable of type A In the view here: any open argument slot of type X can be an open argument slot of type $<A,X>$. (A is usually type e.) The paycheck generalization is automatic in the program here; it follows from the existence of **g** and **z** which 'open up'

So, while the paycheck generalization itself is not automatic under standard conceptions, it is true that if some apparatus can be invoked in such views to get this generalization, than all of the cases under "paycheck generalization" would need just this one bit of apparatus. The discussion of functional questions in, .e.g, Engdahl (1986) anticipates this point, and clearly unites the case with paycheck readings of pronouns (as discussed in, e.g., Cooper 1979) with functional questions. Again, though, the generalization itself is automatic in

the variable free view, and none of these phenomena would have ever been seen as a surprise.

• *Cases falling under the paycheck generalization*:

  • Functional questions [**2**], [**5**]
  • Functional relative clauses/functional readings for NPs [**2**]
  • Paycheck readings for pronouns [**6**]
  • Complex domain restrictions (of the sort first noted in von Fintel, 1994) [**15**]
  • Complex comparison classes for adjectives (e.g., *All of John's children are tall,*
      Kennedy, 1997) [**15**]

• *Other cases which follow from the basic apparatus here which are not instances of the paycheck generalization*

• the appropriate gender feature on paycheck pronouns [**6**]
• i-within-i effects (given a Categorial Grammar syntax) [**6**]
      • some exceptions to i-within-i effects shown in example (12) above [**6**]
      • interactions of i-within-i effects and paycheck pronouns [**6**]
• Pied Piping semantics without reconstruction [**4**]
      *Note: The Pied-Piping account in [**4**] and elsewhere is incomplete in that it needs*
          to be hooked into a <u>syntax</u> which allows this. This will be done in
          forthcoming work; it involves only making use of the type of wh-feature
          passing conventions that were developed in Gazdar, Klein, Pullum and
          Sag (1985), translated into a Categorial Grammar.
• Pied Piping interactions with ACD as in (8) [**4**]
      Note: This assumes some principle to ensure that (T)VP 'ellipsis' is in a domain
          with focus. Rooth's condition is one version of this. Any theory apparently
          needs some such condition. Hopefully it would follow from something; for
          *some relevant discussion, see [**17**[.*
• Weak Crossover effects [**5**]
      Note: This effect is built into the system. It is 'automatic' in the sense that no extra
          stipulation is needed (as is often the case in other account), but it is not
          *fully 'automatic' in that things could have been otherwise. See [**5**] for*
          discussion.
• Interaction of WCO with functional questions and with paycheck pronouns [**6**]
• Answers to functional questions (without ellipsis) [**2**], and for arguments against the
      ellipsis analysis of short answers, see Jacobson (2016, *Language* - link above
      under [**2**]
• "Binding" connectivity in specificational sentences comes out from the existence of
      functional readings for NPs ('functional relatives') plus the same mechanism as
      the short answer for functional questions [**2**]
• ACD and other cases of 'TVP' ellipsis, including other so-called 'rebinding' cases [**1**], [**9**],
      [**17**]
• Across-the-Board Binding (and some complex patterns allowed as well as readings which
      are disallowed) [**3**], [**5**]
• 'Kennedy's puzzle' (without any use of indices and a No Meaningless Coindexation
      stipulation) [**10**], [**12**], [**17**]
      Caveat: Heim adopted the 'formulas' hypothesis rather than predicates in order
          to make sure that relative clauses and the arguments of generalized quantifiers
          were not of type <e,t> since if they were they could form an appropriate contrast,
          removing the basic explanation for the puzzle. Kennedy (SALT 24) sought
          *a revision to this which did not require the formulas hypothesis; [**17**] above shows*
          that his revision is not sufficient. However, the caveat here is that potentially an

analogous problem could arise in the variable-free view due to details of how focus computation works. In [17] I solve this but the solution is arguably somewhat stipulative; ultimately the hope is that this can follow from something but at this point it doesn't. Since there is a stipulation built in, it turns out that the variable-ful analysis could have made an analogous stipulation. So it is not really correct to say that everything is solved under variable-free, but it does at least as well as Heim/Kennedy and removes the nead for No Meaningless Coindexation.

• A restatement of some MaxElide effects as type rather than size competition [17]

Note: This recasting makes it more likely for the explanation to ultimately be rooted in commuicative goals rather than just being a grammatical stipulation. Additional data in [17] which is accounted for by type competition but not size competition.

Second group: Phenomena for which is need a bit of 'extra machinery' - all of which documented (albeit informally) above

• Binding into head nouns (without reconstruction) [8], [16]
    • including pattern with stacked relatives as in (28) (problematic for reconstruction account) [16]
    • including data in (27) (problematic for reconstruction account) [16]
    • complex binding patterns in heads of the type in (20) (for revised examples, see [16] (problematic for reconstruction account)
• Interaction of paycheck pronouns with 'uninterpretable features' as shown in (25) and (26) [14]
• Principle B effects [11]
    single principle rather than an analogue to Principle B + Rule I
    both of the above have various problems documented in [11]

Third group: A bit more tentative since there are some unresolved issues:

• Focus on bound pronouns [7]
    • The fact that there are two ways to interpret contrastively stressed pronouns as in (16a) vs. (16b) [7] (see also the reflexive contrasts in (17)
    • The fact that paycheck pronouns don't allow the same type of focus/contrastive stress as in (15) [7]