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Born to Parse
How Children Select Their Languages

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4   Parsing at Interfaces

4.1   Logical Form: Pronouns

So far we have been discussing syntactic well-formedness in terms of what UG prescribes about syntactic structures and what is learned by children through the parsing process, that is, through discovery and selection. However, in the most general terms, languages are systems in which syntax connects meaning to some form of EXTERNALIZATION. Meanings, as framed by logicians, philosophers, and linguists, are "logical forms," consisting of units formed from subunits, head–complement relations, phrase–adjunct relations, thematic roles, indexical relations, topic–comment relations, presupposition–assertion distinctions, and much more. For every syntactic structure, there is a logical form, specifying aspects of the meaning, associated with an externalization.

In most people, the syntax connects meaning and sound: the externalization consists of a phonological form for the expression. Thus, in these individuals, for every syntactic structure there is a corresponding externalization that specifies aspects of the sound and a logical form that specifies aspects of the meaning. These are interpreted at the "sensorimotor" and "conceptual-intentional" interfaces respectively, which have their own well-formedness conditions. Those well-formedness conditions interact with learned,

variable properties and therefore involve parsing on our approach. For a significant minority, the externalization is some kind of signed system, not based on sounds, but on gestures like those of American Sign Language or the new Nicaraguan Sign Language. For smaller minorities, the externalization might be tactile; the Tadoma method is one such system. Whatever the externalization used, sound, sign, or touch, the point is the same all around. Phonologists, beginning in the early twentieth century, did fundamental work developing rich descriptive systems based on the theories of contrast and distinctive features of Roman Jakobson, Edward Sapir, Nikolai Trubetzkoy, and others (Jakobson 1941; Sapir 1925; Stokoe 1960; Trubetzkoy 1939). In the 1960s, analysts followed the seminal work of William Stokoe of Gallaudet University in Washington, DC, and set about understanding how signed languages conveyed the meanings that syntacticians had discovered in working on oral languages. Soon a vibrant research community emerged, finding that signed systems were as rich and complex as oral systems and making fundamental discoveries about individual signed languages, which proved to bear essentially no relation to their ambient oral languages.

In this chapter we will consider some difficult ellipsis phenomena that interact with both the sensorimotor interface and the conceptual-intentional interface and have interesting logical and phonological consequences. They also do not manifest the properties one would expect if linguistic variation were due to binary parameters defined in UG. Let us begin by considering the conceptual-intentional or syntax–meaning interface, in particular the Binding Theory and the parsing issues that it raises. The logical form will involve the *interpretation* of pronouns, particularly those in ellipsed VPs, such as *Papa Bear wiped his face and Brother Bear did* ~~wipe his face,~~ *too.* Then in the next section we will consider the *distribution* of ellipsed VPs, determining where VPs may be reduced to silence in this way.

The early history of generative grammar spawned many publications on the way in which pronouns could refer to people and objects. Linguists offered complex indexing procedures, whereby DPs might have the same or different indices, depending on whether they referred to the same or different entities. For a taste of the kind of unpleasant complexity invoked, see the appendix to Chomsky 1980 and the indexing procedures postulated there. Fortunately, the classical Binding Theory was introduced soon after, in Chomsky 1981a, and consisted of just three principles, simplifying matters enormously:

(1) A. Anaphors are bound locally.
    B. Pronouns are free locally.
    C. Names are free.

To be bound locally meant being coindexed with a higher, C-COMMANDING expression that is local, within its DOMAIN; being free meant not being coindexed with a local c-commanding expression. Those three principles, simply known as Principle A, Principle B, and Principle C, permitted a dramatic simplification of analyses. By hypothesis, they constitute a component of UG, available to humans in advance of experience, in fact enabling children to interpret their experience. The principles facilitate structures that can meet the demands of learnability, because children only need to learn which nominals are anaphors and pronouns, which does not look difficult. The principles divide nominals into three types: anaphors like the reflexive pronouns *himself*, *themselves*, and so on (in English), pronouns like *she*, *her*, *their*, and names (all other nominals). Each nominal is contained inside a Domain, roughly its clause or a larger DP, and it is either coindexed with another, higher DP within that Domain or not. If so, then it is bound locally; if not, then it is free locally. The Binding Theory, in modern terms, involves the indexical relations that make up a well-formed logical form; it is part of the conceptual-intentional interface.

As one way of visualizing things, for an expression *Kim's mother washed herself*, whose structure is represented in (2), an analyst might start from *herself* and proceed up the hierarchical structure from one node to another. If a node is reached on this upward trajectory whose sister is a DP, that DP is a potential binder for *herself*. This approach involving tree climbing and sister checking enables us to capture the basic technical notion of c-command. The analyst gets as far as the lower IP, at which point there is a DP that is a sister to this node: *Kim's mother*.

(2)
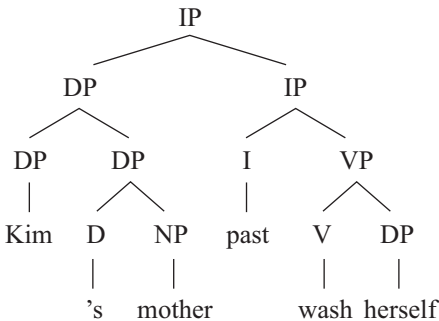
Herself must be coindexed with (and refer to) this maximal DP *Kim's mother*; it may not refer to the lower DP *Kim*, because that lower DP is not a sister to the IP—it is contained within the larger DP and is therefore inaccessible to the Binding Theory.

The representation in (3a) is an alternative and partial representation of (2).

(3) a. $_{DP}[\ _{DP}[\text{Kim}]$'s mother$]_i$ washed herself$_i$.
   b. $_{DP}[\ _{DP}[\text{Kim}]$'s mother$]_j$ washed her$_i$.
   c. $_{DP}[\ _{DP}[\text{Kim}]$'s mother$]$ said $_{CP}[$that the doctor$_i$ washed her$_j]$.
   d. $_{DP}[\ _{DP}[\text{Kim}_i]$'s mother$]_j$ said $_{CP}[$that the doctor$_i$ washed Kim$_i]$.

e. Kim said $_{CP}$[that the doctor$_i$ washed her$_j$].

f. Kim$_i$ said $_{CP}$[that the doctor washed Kim$_j$].

Now consider (3b): it has the same structure, just with *her* in place of *herself*—and *her* may not be coindexed with the DP *Kim's mother*, because as a pronoun it needs to be free in its clause. It may, on the other hand, be coindexed with *Kim*, precisely because the DP *Kim* is not a sister to the IP (or any node reached by moving up the tree node by node starting with *her*) and is, therefore, irrelevant to the demands of the Binding Theory. Next, note that (3c) is ambiguous: *her* may refer to *Kim* or to *Kim's mother*. The Binding Theory stipulates only that *her*, a pronoun, be free within its own Domain, the clause (CP) indicated; beyond that, there is nothing systematic to be said and any indexing is possible. Similarly, in (3e) *her* may be coindexed with *Kim*, because *her* is thus free (not coindexed with anything) within its own clause; or it may have its own unique index, referring to a woman other than Kim. Turning to names, note that the difference between them and pronouns is that while pronouns only need to be free locally, the need of names to be free is not limited to their own Domain. On the one hand, (3d), with its two *Kim*s, can be a statement about one Kim; the lower *Kim*, the complement of *washed*, may not be coindexed with any sister DP we meet as we work our way up the tree structure (not stopping at the CP node but continuing to climb), but the higher DP *Kim* is not a sister to any node dominating the lower *Kim*, hence invisible to the Binding Theory. On the other hand, (3f) necessarily concerns two Kims; the lower *Kim* may not be coindexed with the higher *Kim*, whose DP is a sister to the IP node dominating the lower *Kim*.

The Binding Theory yields the necessary distinctions beautifully but itself cannot be learned from data accessible to young children, the PLD. We therefore say that it is part of UG, part of what children bring to the analysis of initial experience. Learning is involved, however: children must learn which words are anaphors and which

are pronouns, but nothing more complex is needed. The three pos-
sibilities are defined in (1) and they hold for all languages. Once a
child acquiring English has learned that *themselves* is an anaphor,
her a pronoun, and so on, all the appropriate indexing relations fol-
low, with no further learning. Similarly for other languages, chil-
dren learn which words are anaphors and pronouns and everything
else follows. How, then, do they learn which words are which? We
will see that parsing must be involved.

Exposure to a simple sentence like (4a), interpreted with *them-
selves* referring to (coindexed with) *they*, suffices to show that *them-
selves* is an anaphor and not a pronoun or a name; pronouns and
names may not be thus coindexed with an accessible phrasal cate-
gory within their Domain.

(4) a. They$_i$ washed themselves$_i$.
     b. Kim$_i$'s father loves her$_i$.
     c. Kim$_i$ heard $_{DP}$[Bill's speeches about her$_i$].
     d. Kim left.

The sentence in (4b), interpreted with *her* referring to *Kim*, shows
that *her* is no anaphor, since it is not coindexed with any sister DP
encountered as we move up the tree structure within *her*'s Domain.
And (4c), with *her* referring to *Kim*, shows that *her* is not a name,
since names may not be coindexed with a sister DP anywhere; the
Domain of *her* is the DP indicated and *her* is free within that
Domain, happily. If neither an anaphor nor a name, then *her* is a
pronoun. So far, so good but here comes the snag.

A very simple expression like (4d) shows that *Kim* is not an ana-
phor, but there is no positive evidence available to a child showing
that *Kim* is not a pronoun. Analysts know that *Kim* is not a pronoun,
because one does not find sentences like *Kim said that Kim left*, with
the two *Kim*s referring to the same person, but that is a negative
datum, information that something doesn't occur, hence unavail-

able to young children. So a complication has arisen; but it can be resolved by appealing to hierarchical organization.

If we turn to hierarchical relations, the starting point for a child might be that every word is a name, unless there is positive, refuting evidence. Under that view, sentences like (4a) show that *themselves* is not a name, and not a pronoun either, hence an anaphor. And (4c) shows that *her* is not a name, because it is coindexed with an accessible sister DP (*Kim*), and not an anaphor, because it is not locally coindexed, hence a pronoun. This yields a satisfactory account. We have a theory of mature capacity that provides the appropriate distinctions, and one can show how children learn from environmental data which elements are anaphors (1A) and which are pronouns (1B); all other nominals are names (1C).

However, further work suggests that this problem with the learnability of pronouns may be symptomatic of a bigger issue. Principles A and C, applying to anaphors and names, have stood the test of time well, but Principle B has been problematic from the early days of the Binding Theory. For example, Avrutin and Wexler 1992 observes that Principle B seems to be delayed in Russian-speaking children and does not come into effect until well after Principles A and C. Avrutin and Wexler argue that the effect is illusionary and that, in fact, Russian children behave according to Principle B from the earliest stage but lack a particular pragmatic principle, which they spell out (below). That is what makes it appear that Russian children lack Principle B.

According to Grodzinsky and Reinhart 1993, Principle B applies only to pronouns that are bound variables, hence to the pronoun in *Is every bear touching her?* but not to the pronoun in *Is Mama Bear touching her?*, which can be referential. A clear instance of a nonreferential pronoun is *No bear likes his father*, where there can be no referent for *no bear* and therefore none for *his*. If Principle B does not apply to referential pronouns, one may wonder why *Mama*

Bear is touching her does not mean the same as the corresponding sentence with an anaphor, *Mama Bear is touching herself.* For that reason, Grodzinsky and Reinhart invoke a special rule, their Rule I: "NP A cannot co-refer with NP B if replacing A with C, C a variable A-bound by B, yields an indistinguishable interpretation" (p. 70). The status of such a rule is quite unclear; for good discussion, see Elbourne 2005.

And, talking of Elbourne, he claims (p. 361) that languages vary in terms of whether they observe Principle B: earlier forms of English and Maori, for example, do not. That leads him to conclude that Principle B is subject to a parameter and that children have to learn it only if it applies to their I-language. However, as Elbourne notes, there is a serious problem with that proposal: as we noted four paragraphs back, learning the principle would require access to negative evidence, information that certain things do not occur in the language.

Also contributing to this literature on the special properties of pronouns, Thornton and Wexler 1999: chap. 2 surveys empirical investigations showing that children have Principles A and C but not Principle B. Thornton and Wexler (p. 9) find that Principle B "stands out as an empirical problem area," as argued by Elbourne. They adapt the proposal of Avrutin's dissertation (Avrutin 1994) and distinguish three analyses of *Mama Bear is washing her face*, what they call the deictic, coreference, and quantificational readings. In the deictic reading, Mama Bear washes somebody else's face, perhaps Snow White's, and there is no coindexing. In the second reading there is coreference between Mama Bear and the pronoun. And the third reading involves a quantificational analysis with a LAMBDA OPERATOR: Mama Bear (λx (x is washing x's face)) (cf. the bound-variable use of pronouns discussed above). The second and third analyses have the same truth conditions and are difficult to tell apart. There has been a vast amount of work on the

interpretation of pronouns and the circumstances under which they may be interpreted as coindexed with a preceding noun phrase; Elbourne 2005 has wise discussion.

Thornton and Wexler argue that children's misinterpretations of sentences like *Mama Bear is washing her*, with *her* referring to Mama Bear, are not violations of Principle B but reflect incomplete pragmatic knowledge. "As a consequence, children accept corefer- ence between a pronoun and a name, what we will be calling a *local coreference interpretation*, in circumstances in which an adult would not" (p. 14). They claim that children have difficulty evalu- ating other speakers' intentions, which has consequences for both speech and understanding of language. Children typically take new information to be old information, in nonadult fashion, explaining why "children may announce 'He hit me' instead of 'A boy hit me' or 'John hit me'" (p. 15). This is why children allow local-coreference interpretations for expressions like *Mama Bear is washing her.*

Thornton and Wexler experiment with VP-ellipsis constructions. They compare children's interpretation of pronouns in simple sen- tences like (5a), governed by Principle B, with their responses to sentences like (5b), governed by Principle C. As noted, children sometimes let the pronoun and the name co-refer in (5a), as adults would never do.

(5) a. Mama Bear is washing her.
    b. She is washing Mama Bear.

Thornton and Wexler also compare children's interpretation of (5a) with their interpretation of pronouns in ellipsed VPs. An example of VP ellipsis is given in (6a); in (6b), the ellipsed VP contains a pronoun.

(6) a. Papa Bear ate pizza and Brother Bear did ~~eat pizza~~, too.
    b. Papa Bear wiped his face and Brother Bear did ~~wipe his face~~, too.

The pronoun in (6b) is multiply ambiguous and may have a deictic, coreference, or bound-variable reading. In simple sentences the coreference and bound-variable readings are hard to distinguish, because they are true under the same truth conditions, as we noted in our discussion above of *Mama Bear is washing her.* In ellipses, however, the truth conditions are different for the two readings. For (6b), the deictic and coreference readings show strict identity (cf. §2.6): the deictic reading takes the two pronouns to refer to a specific individual not mentioned in the sentence, perhaps to Sister Bear, while the coreference reading takes them to refer to Papa Bear, with the second pronoun (in the ellipsed VP) linked to the overt pronoun in both cases. The bound-variable reading, on the other hand, shows sloppy identity. The pronoun is bound in both clauses but by different operators, so it refers to different individuals in each clause.

When we consider the three principles of the Binding Theory, Principles A and C look quite straightforward, and it is easy to see how children learn what an anaphor is and what is a name. Principle B is different and there is substantial learning involved, which seems to require parsing on the part of our children; the literature shows children having difficulty with Principle B. Elbourne 2005 surveys experimental work by many researchers investigating children's use of pronouns and the different ways they link to other DPs. If Principle B were simply part of the toolbox made available by UG like Principles A and C, we would expect similarly uniform linguistic behavior of children and rapid, accurate learning. Instead, we see children behaving quite differently, depending on the language they are selecting and their age.[1] Children appear to be challenged by the behavior of pronouns and to be conducting detailed analysis, sometimes arriving at systems that differ from those of the adults around them.[2]

We see that the Binding Theory needs to be part of the conceptual-intentional interface, part of what is given by UG, but it interacts

with variable properties, which have to be learned and therefore involve parsing. No proposal for this kind of phenomena has been provided in terms of binary parameters whose content is stated at UG, as far as I am aware. If children are born to parse and if parsing is of fundamental importance, we can see how they might arrive at an appropriate analysis, incorporating much variation depending on the language being selected and the age at which learning takes place.

4.2 Phonological Form: Not Pronounced

Now let us turn to the sensorimotor interface and the requirements for the phonological form of expressions (one of the possible externalizations). We will be concerned with when elements may go unpronounced. Ellipsed VPs (VPs rendered silent through the operation of ellipsis) are unusual across languages, but English allows them, and children have plenty of evidence to that effect, as illustrated in (7). They occur in a wide range of structures, but they need a "host," an adjacent overt head that licenses them. The suggestion is that empty VPs occur only where they cliticize onto an adjacent host.[3] In (7a) the empty VP is the complement of *did*, and *did* hosts it. Of course, VP ellipsis only applies to VPs: (7b) is ill-formed because part of the VP remains, *for Naples*, and there is no null VP. In the ungrammatical (ii) structures of (7c,d), the null VP is separated from its potential host *had*, hence their ungrammaticality can be attributed to failure to cliticize. A properly hosted ellipsed VP may occur in a subordinate clause (7e), to the left of its antecedent (7f), in a separate sentence from its antecedent (7g), within a complex DP (7h), with an antecedent that is contained in a relative clause (7i), or even without any overt antecedent (7j).

(7) a.   Max left on Wednesday but Mary did $_{VP}$[~~leave on Wednesday~~] as well.

   b.   *Max left for Rio but Mary didn't $_{VP}$[~~leave~~ for Naples].

   c.   i.   They denied reading it, although they all had $_{VP}$[~~read it~~].

      ii.   *They denied reading it, although they had all $_{VP}$[~~read it~~].

   d.   i.   They denied reading it, although they often/certainly had $_{VP}$[~~read it~~].

      ii.   *They denied reading it, although they had often/certainly $_{VP}$[~~read it~~].

   e.   Max left for Rio, although Mary didn't $_{VP}$[~~leave for Rio~~].

   f.   Although Max couldn't $_{VP}$[~~leave for Rio~~], Mary was able to leave for Rio.

   g.   Susan went to Rio.
      Yes, but Jane didn't $_{VP}$[~~go to Rio~~].

   h.   The man who speaks French knows $_{DP}$[the woman who doesn't $_{VP}$[~~speak French~~]].

   i.   People who appear to support mavericks generally don't $_{VP}$[~~support mavericks~~].

   j.   Don't $_{VP}$[~~??~~]!

   It appears that an ellipsed VP must cliticize (or incorporate in some other way) to the left, to a host head of which it is the complement:

(8) Max could visit Rio and Susan $_{INFL}$could + $_{VP}$[~~visit Rio~~], too.

This requirement explains the nonoccurrence of (9a), noted in Zagona 1988: the ellipsed VP needs an appropriate, adjacent host, a full phonological word, of which it is the complement, as in (9b). In (9a), *has* has become part of the noun *John* and no longer heads a phrase of which the empty VP is the complement.

(9) a.   *I haven't seen that movie, but John's $_{VP}$[~~seen the movie~~].

   b.   I haven't seen that movie, but John [has + $_{VP}$[~~seen the movie~~]].

Consider now null complementizers and deleted copies, where something similar seems to be at work, as discussed briefly in §1.1 (see (5)–(8) there). A child might hear sentences like (10a–c) pronounced with or without the complementizer *that*, because in English both versions occur. Such experiences would license an operation of the form in (10d) whereby *that* is deleted or rendered silent. French, Dutch, and German children have no comparable experiences and hence no grounds to parse a comparable deletion operation in their grammars; nothing like (10d) is triggered and there is no optionality for them; the complementizer must be present.

(10) a. Peter said [that/0 Kay had left already].
  b. The book [that/0 Kay wrote] arrived.
  c. It was obvious [that/0 Kay left].
  d. that → 0

So experience licenses the operation in (10d) for children acquiring English; but a linguist may observe that as a generalization, (10d) breaks down at certain points: *that* may not be null in the contexts of (11). The crucial data here are negative data, data about what does not occur, which are not available to children. Hence UG must be playing some role.

(11) a. Peter said yesterday [that/*0 Kay had left already].
  b. The book arrived yesterday [that/*0 Kay wrote].
  c. [that/*0 Kay left] was obvious to all of us.
  d. Fay believes, but Kay doesn't, [that/*0 Ray is smart].
  e. Fay said Ray left and Tim $_\text{V}$e [that/*0 Jim stayed].
  f. Fay said [that/0 [that/*0 the moon is round] is obvious].

What we see here is that, much as with ellipsed VPs, *that* can be deleted only if the clause it occurs in is the complement of an overt, adjacent word. In (11a,b) the clause is the complement of *said* and *book* respectively, neither adjacent.[4] In (11c), the clause is the com-

plement of nothing. In (11d) it is the complement of *believes*, which is not adjacent, and in (11e) it is the complement of a verb that is not overt. In (11f) the lower complementizer may not be null because its clause is not the complement of *said*.[5]

The same condition holds for what we used to view as "traces" of *wh-* movement. English-speaking children learn that *wh-* elements are displaced, that is, pronounced in a position other than where they are understood, on hearing and understanding a sentence like (12a). On Minimalism's Copy-and-Delete implementation of displacement, there are actually multiple copies of the same element; an independent principle says that only one of them may be pronounced (in this case, it is the sentence-initial one), entailing deletion of all the others. For more on this, see note 7. In (12a′,b′), the structures posited for (12a,b), the lowest *who* is the complement of the adjacent verb, and in (12b′), the intermediate *who* occurs in a clause that is the complement of the adjacent verb *say*.

(12) a. Who did Jay see?
     b. Who did Jay say ~CP~[that Fay saw]?
        a′. Who did Jay see ~~who~~?
        b′. Who did Jay say ~CP~[~~who~~ that Fay saw ~~who~~]?

Assuming the Copy-and-Delete Minimalist structures of (12a′,b′), a copy of *who* can be deleted only when it or the clause in which it occurs is the complement of an adjacent, overt word. If that is the condition, it predicts, with no further learning, that (13a) is ill-formed, because the boldface **who** is undeletable (henceforth, boldface indicates a copy that cannot be deleted as required): it is in a clause that is the complement of *apparent* but not adjacent to it. The lowest *who* is the complement of the adjacent, overt *seen*, hence deletable. Also, if *yesterday in Chicago* were not present in (13a), then it *would* be the case that *who* was in an adjacent complement of the overt *apparent*, hence deletable; this yields the well-formed (13b), where (13b′) is the Copy-and-Delete representation.

(13) a. *Who was it apparent yesterday in Chicago _{CP}[**who** that
             [Kay had seen ~~who~~]]?
             i.e.,
             *Who was it apparent yesterday in Chicago who that Kay
             had seen?
             and
             *Who was it apparent yesterday in Chicago 0 that Kay
             had seen?
       b. Who was it apparent that Kay had seen?
       b′. Who was it apparent [~~who~~ that Kay had seen ~~who~~]?

We thus solve the poverty-of-stimulus problem posed by (13a) as
follows: children learn simply that *wh-* items may be displaced (cop-
ied and deleted), and the interface condition requiring deleted
items to cliticize onto an adjacent host causes the derivation of (13a)
to crash with no further learning.

   Other contexts likewise indicate that items may be deleted only
if they are the complement or in the complement of an overt, adja-
cent word. So *which man* is deletable in the leftmost conjunct of
(14c) (the complement of the adjacent *introduce*) but not the bold-
face **which woman** in the rightmost conjunct, the complement of a
nonovert verb. Hence the corresponding sentence is ill-formed.
Similarly, in (14d,e,g), the boldface element fails to meet the con-
dition for deletion, because the relevant verb is not overt. These
structures involve *wh-* movement (14c,d), readily learnable as noted
above; heavy-DP shift (14e,g), learnable on exposure to simple
expressions like *John gave to Ray his favorite racket*; and gapping
(14c,d,e,g), learnable on exposure to things like (14b,f). The UG
principle then solves the poverty-of-stimulus problems of
(14c,d,e,g).[6]

(14) a. Jay introduced Kay to Ray and Jim introduced Kim to
             Tim.
       b. Jay introduced Kay to Ray and Jim _V*e* Kim to Tim.

c. *Which man$_i$ did Jay introduce ~~which man$_i$~~ to Ray and
   which woman$_j$ Jim $_\text{v}e$ **which woman$_j$** to Tim?
   i.e.,
   *Which man did Jay introduce to Ray and which woman
   Jim which woman to Tim?
   and
   *Which man did Jay introduce to Ray and which woman
   Jim 0 to Tim?
d. *Jay wondered what$_i$ Kay gave ~~what$_i$~~ to Ray and what$_j$
   Jim $_\text{v}e$ **what$_j$** to Tim.
e. *Jay admired [~~his uncle from Paramus~~]$_i$ greatly [his uncle
   from Paramus]$_i$ but Jim $_\text{v}e$ [**his uncle from New York**]$_j$
   only moderately [his uncle from New York]$_j$.
f. Jay gave his favorite racket to Ray and Jim $_\text{v}e$ his
   favorite plant to Tim.
g. *Jay gave [~~his favorite racket~~]$_i$ to Ray [his favorite racket]$_i$
   and Jim $_\text{v}e$ [**his favorite plant**]$_j$ to Tim [his favorite
   plant]$_j$.

The same condition explains why a complementizer may not be
null if it occurs to the right of a gapped (nonovert) verb, as in (15b);
nor does one find a deleted copy in that same position, as with the
boldface **who** in (15c).

(15) a. Jay thought Kay hit Ray and Jim $_\text{v}e$ $_\text{CP}$[that Kim hit Tim].
     b. *Jay thought Kay hit Ray and Jim $_\text{v}e$ $_\text{CP}$[**0** Kim hit Tim].
     c. *Who$_i$ did Jay think Kay hit ~~who$_i$~~ and who$_j$ Jim $_\text{v}e$
        $_\text{CP}$[**who$_j$** (that) [Kim hit ~~who$_j$~~]]?

So, children exposed to some form of English have plenty of evi-
dence that a *that* complementizer is deletable (10d), that *wh*- phrases
may be displaced (copied), and that heavy DPs may be copied to
the end of a clause (14e,g); but they also know *without evidence* that
complementizers and copies may not be deleted unless they are the
complement or in the complement of an adjacent, overt word. And

the data of (10–15) suggest that this is the information that UG needs to provide and that head–complement relations are crucial. The convergence of that information with the I-language-specific devices that delete a *that* complementizer and allow a *wh-* phrase or a heavy DP to be copied yields the distinctions we have noted and solves the poverty-of-stimulus problems.[7] The UG requirement guarantees that deleted items must be understood in structurally prominent positions, where they have an appropriate host. This might be motivated by parsing needs: the possibility of a deleted item need only be considered where there is an appropriate host for one. The absence of an appropriate host rules out a deleted element; correspondingly, the presence of an appropriate host is a potential cue to the presence of a deleted item.

More evidence for this interface requirement comes from failures of verb reduction. The verbs *is*, *am*, *are*, *has*, *have*, *had*, *will*, *would*, and *shall* may reduce: *Kim's happy*, *Jim'll do it*, *Sarah'd read it*, and so on. However, by now readers are not surprised that there are apparent exceptions: for example the boldface instances of *is* in *Kim's happier than Tim **is**, I wonder what the problem **is**, I wonder what that **is** up there, I wonder where the concert **is** on Wednesday* may not reduce. These data, negative data concerning contexts where *is* does not reduce, are not available to children directly, and that is the familiar poverty-of-stimulus problem: the stimulus appears to be too poor to determine all the properties of the mature system. Children hear some instances of the reduced forms but somehow come to know much more, namely that *is* may be reduced generally but not in the boldface contexts above. But notice that the boldface items each precedes a deletion site, as shown in (16). Our emerging analysis suffices to explain the nonreduction: the full form is needed to license the deletion site.[8]

(16) a. Kim is happier than Tim **is** ~~happy~~.
   b. I wonder what the problem **is** ~~what~~. (Cf. *The problem's twofold*.)

    c. I wonder what that **is** ~~what~~ up there. (Cf. *That's a fan up there*.)

    d. I wonder where the concert **is** ~~where~~ on Wednesday. (Cf. *The concert's in Nogales on Wednesday*.)

All is well so far, but now the question is: *how* is *what* deleted? Let us first review effects of earlier restrictions and see how we might capture them with the economy and elegance that the Minimalist Program encourages.

We know that elements may cliticize to the left and become an inseparable part of their host. That happens with the reduced *is* discussed earlier. When *is* reduces, its pronunciation is determined by the last segment of the word to which it attaches, as (17a) illustrates: voiceless if the last segment is voiceless, voiced if the last segment is voiced, and syllabic if the last segment is a sibilant or affricate. Precisely the same is true of the plural marker, the possessive, and the third-person singular ending on a verb, illustrated in (17b–d) respectively.

(17) a. Pat's happy, Doug's happy, and Alice's here.
     b. cats, dogs, and chalices
     c. Pat's dog, Doug's cat, and Alice's crocodile
     d. commits, digs, and misses

Children understand *Pat's happy* as 'Pat is happy', *Pat* being the subject of the phrase 'is happy'. However, *is* is pronounced inseparably with *Pat*, and children parse what they hear as (18a), that is, with reduced *is* attached to the noun, with normal pronunciation applying. What (18a) expresses is a piece of structure, (18b), that serves to determine the shape of the emerging grammar, showing particularly that elements may be cliticized (Lightfoot 1999, 2006a). So from hearing and understanding an expression like *Pat's happy*, children learn that *is* may be reduced and absorbed into the preceding word. Again we see the effects of parsing.

(18) a. $_N$Pat + 's
      b. noun + clitic

If we draw (17) together with (19), we now find something interesting: copies do not delete if they are to the right of a cliticized verb. In (19), the copied elements may be deleted if *is* is in its full form, but not if it is reduced; the corresponding sentences with *'s* do not occur.

(19) a. Kim is happier$_i$ than Tim is/*Tim's ~~happy~~$_i$.
      b. That is a fan up there.
      c. I wonder what$_i$ that is/*that's ~~what~~$_i$ up there.
      d. I wonder where$_i$ the concert is/*concert's ~~where~~$_i$ on
          Wednesday.

This suggests again that a deleted copy is incorporated into the element of which it is the complement. In (19), if *is* cliticizes onto the subject noun and becomes part of that noun, it no longer heads a phrase of which *what/where* is the complement, and no incorporation is possible, hence no deletion if deletion is incorporation or cliticization.

   That idea enables us to capture another subtle and interesting distinction. The sentence in (20a) is ambiguous: it may mean that Mary is dancing in New York or just that she is in New York (working on Wall Street, say, not dancing). The minimally different (20b), however, only has the latter interpretation. The 'dancing in New York' interpretation of (20a) has a structure with an empty verb, understood as 'dancing', represented in (20c). If empty elements (like an understood verb) are incorporated, there must be an appropriate host. There is an appropriate host in (20c), where the empty verb cliticizes onto a full verb, *is*, but not in (20d): $_V$*e* isn't the complement of *Mary's*, therefore it is not licensed. Consequently (20b) unambiguously means that Mary is in New York (occupation unspecified), because there is no empty, understood verb. Again, it

is inconceivable that children *learn* such distinctions purely on the basis of external evidence.

(20) a. Max is dancing in London and Mary is in New York.
      b. Max is dancing in London and Mary's in New York.
      c. Max is dancing in London and Mary is $_v e$ in New York.
      d. *Max is dancing in London and Mary's $_v e$ in New York.

So copies are deleted in the phonology in order to satisfy linearization requirements, and our analysis takes deletion to be an instance of cliticization, which allows the analysis to generalize to other null elements, such as copies, as already discussed above. In (21a) the deleted complement cliticizes onto the adjacent *see*, and in (21b) the deleted *Jay* is in the complement of *expected*, which is adjacent to it, and accordingly cliticizes onto it.

(21) a. Who$_i$ did Jay see ~~who~~$_i$?
      b. Jay$_i$ was expected [~~Jay~~$_i$ to win].

The analysis appeals to head–complement relations and adjacency.

Our analysis captures many other distinctions. For example, English speakers' grammars typically have an operation whereby a "heavy" DP is displaced to the right (see (14e,g) above). Under our Copy-and-Delete approach that means merging a copy to the right and reducing the first copy to silence by absorbing it clitic-like into a host. In (22a) the copied element is the complement of *introduced*, hence incorporated and deleted successfully; in (22b) it is in the complement of the adjacent *expect*; but in (22c) the element that needs to be deleted is neither the complement nor contained in the complement of anything, and the derivation is ill-formed and crashes.

(22) a. I introduced [~~all the students from Brazil~~]$_i$ to Mary [all the students from Brazil]$_i$.
      b. I expect [[~~all the students from Brazil~~]$_i$ to be at the party] [all the students from Brazil]$_i$.

   c. *[[**All the students from Brazil**]$_i$ are unhappy] [all the students from Brazil]$_i$.

Our UG principle, that deletion of this kind is cliticization or incorporation, solves the poverty-of-stimulus problem of (22c): children simply learn that heavy DPs may be copied to the right, and the UG condition accounts for the nonoccurrence of (22c) with no further learning or experience needed.

    Our analysis can also solve a puzzle about genitives and DP structure, discussed in §3.1. Whereas a simple DP like *a book* has the structure $_{DP}[_D a \ _N book]$, a DP like *Kim's book about syntax* has the Determiner *'s* governing (and assigning Case to) its specifier, the genitive *Kim*, as well as its complement $_{NP}[book \ about \ syntax]$. Consider now an expression like *Jay's picture*. It is three-ways ambiguous: Jay may be the owner of the picture, the painter, or the person portrayed. The latter reading is the so-called objective genitive and is usually analyzed as in (23), where *Jay* is copied from the "object" position to the specifier of the DP. The operation is specific to grammars of English speakers and does not occur in French, for example. This much is learnable: children hear expressions like *Jay's picture* in contexts where it is clear that Jay is pictured.

(23) $_{DP}[Jay_i\text{'s} \ _{NP}[\text{picture} \ \cancel{Jay_i}]]$

The curious thing is that comparable expressions like *the picture of Jay's*, *The picture is Jay's*, and *the picture that is Jay's* show only a two-way ambiguity, where Jay may be the owner or the painter but not the person portrayed. This is yet another poverty-of-stimulus problem, because it is inconceivable that children are systematically supplied with evidence that the objective interpretation is not available in these cases. We have an explanation for this, as already noted in §3.1: the structure of these expressions would need to be as follows.

(24) a. *the picture of $_{DP}$[Jay's $_{NP}$[~~picture~~ **Jay**]]   (*the picture
            of Jay's*)
     b. *the picture is $_{DP}$[Jay's $_{NP}$[~~picture~~ **Jay**]]   (*the picture
            is Jay's*)
     c. *the picture that is $_{DP}$[Jay's $_{NP}$[~~picture~~ **Jay**]]   (*the picture
            that is Jay's*)

A preposition like *of* in (24a) is always followed by a DP, a posses-
sive like *Jay's* occurs only as the fused specifier and head of a DP,
and Ds always have an NP complement, even if the noun is empty,
as it is here (where it is understood as 'picture'). Now we can see
why the structures are ill-formed: the copied *Jay* has no host to clit-
icize onto, hence it is undeletable (boldface) and the derivation
crashes. *Jay* is the complement of the adjacent noun, but that noun
is not overt, hence not a viable host.

   The pair in (25) reflects another distinction covered by our
account. The sentence in (25a) is well-formed and involves no
deletion of a copied element, whereas (25b) involves two instances
of DP copying and deletion (to yield the passive constructions).
The leftmost instance is well-formed, because the copied *Jay* is in
the complement of the adjacent *known* and therefore deletes; how-
ever, in the rightmost conjunct, the copied *he* has no overt host to
cliticize onto and therefore cannot be deleted as required, leading
the derivation to crash.

(25) a.   It is known that Jay left but it isn't $_V e$ that he went to the
            movies.
     b.   *Jay$_i$ is known [~~Jay$_i$~~ to have left] but he$_i$ isn't $_V e$ [**he**$_i$ to
            have gone to the movies].

And there is more: it is well known that an expression like *They
were too angry to hold the meeting* is ambiguous, meaning either
that they were so angry that they couldn't hold the meeting or that
some unspecified person (e.g., the speaker) couldn't hold the meet-
ing; the ambiguity lies in who was in charge of holding the meet-

ing (Chomsky 1986: 33). The former reading has the structure of (26a), where *they* is copied and deleted; the CP is the complement of *angry* and *they* is in that complement and adjacent to *angry*, hence incorporated. The other reading has arbitrary PRO as the subject of *hold*, as shown in (26b): nothing is copied, and that would not be possible because the clause is an ADJUNCT to *angry*, not a complement (adjuncthood is represented here by italics).

(26) a.   They$_i$ were too angry $_{CP}$[~~they$_i$~~ to hold the meeting].

   b.   They were too angry *$_{CP}$[*PRO$_{arb}$ to hold the meeting*]*.

   c.   Which meeting$_i$ were they$_j$ too angry $_{CP}$[~~which meeting$_i$~~ [~~they$_j$~~ to hold ~~which meeting$_i$~~]]?

   d.   *Which meeting$_i$ were they$_j$ too angry *$_{CP}$[***which meeting$_i$** [PRO$_{arb}$ to hold ~~which meeting$_i$~~]*]*?

However, the corresponding question *Which meeting were they too angry to hold?* is unambiguous and has only the anaphoric reading, as in (26c), under which *they* are unable to hold the meeting. It lacks the meaning of an arbitrary subject for *hold*: (26d) is ill-formed. In (26c), the clause is the complement of *angry* and therefore *which meeting* in that complement can cliticize onto *angry* and thus be deleted. Likewise, the copied *they* is deleted successively in (26c). (See also (31).) However, in (26d), the clause is an adjunct to *angry*, not a complement, and therefore the intermediate copy of *which meeting* is undeletable.

Several instances of deletion, we have now seen, are subject to poverty-of-stimulus problems suggesting a cliticization or incorporation analysis. Our children are learning what they need to learn through parsing positive data. Other instances of apparent deletion are not subject to comparable poverty-of-stimulus problems and do not fall under a cliticization treatment. Van Craenenbroeck and Merchant 2013 offer a quite comprehensive inventory of deletion processes, instances where elements are not pronounced. In some instances we understand analyses in some

detail, but other examples are less well understood, and work remains to be done on why a cliticization or incorporation analysis works in some places and not elsewhere. Nonetheless the poverty-of-stimulus problems are real and require at least the information invoked here, even if analyses require further elaboration. For example, gapped verbs have a very different distribution from ellipsed VPs, so they do not cliticize in the way that we have analyzed ellipsed VPs here. Compare the gapped verbs in (14, 27) with the ellipsed VPs in (7): their distribution is quite different.

(27) a. *Max speaks French, although Mary $_V e$ German.
   b. *Jim said that Max speaks French and Kim said that
      Mary $_V e$ German.
   c. *Max $_V e$ French and Mary speaks German.
   d. *The man who speaks French knows $_{DP}$[the woman who
      $_V e$ German].
   e. *Max drove to New York and Susan did $_V e$ to Chicago.[9]

So far we have been talking about deletion sites as involving cliticization onto a host, treating the deleted item as some kind of clitic. Indeed, it is profitable to view the incorporated items as clitics. Zwicky and Pullum (1983) distinguish between clitics and AFFIXES, and this distinction permits some further understanding. Specifically, Zwicky and Pullum argue that the English reduced negative *n't* is an affix: so in our terms *isn't*, for example, is formed in the lexicon and merged directly into syntactic structure. That distinguishes between (28b), where *isn't* is merged with *here* to form a constituent, and the ill-formed (28c).

(28) a. John's not here.
   b. John isn't here.
   c. *John'sn't here.

Two of Zwicky and Pullum's criteria for their distinction are given in (29). Criterion F says that affixes may not attach to material already containing clitics, hence the nonoccurrence of (28c).

(29) E. Syntactic rules can affect affixed words, but cannot affect
        clitic groups.
     F. Clitics can attach to material already containing clitics,
        but affixes cannot.

This allows us to distinguish between the structures of (30): criterion E allows a syntactic copying operation (what we used to think of as displacement or movement) to affect *couldn't*, an affixed form, but not *could've*, where *'ve* is cliticized onto *could*.

(30) a. Couldn't Kim see that?
     b. *Could've Kim seen that?

Hence also the grammaticality of the corresponding *Could Kim've seen that?* versus **Could Kimn't see that?*

   If *n't* is an affix, then phonologically reduced verbs (*'s, 've, wanna,* etc.), ellipsed VPs, null complementizers, gapped verbs, and deleted copies are clitics. If clitics may attach to material already containing clitics (29F), we allow (31a–d) but not (31e), which has an affix attached to *could've*, in violation of (29F).[10]

(31) a. Kim visited NY and Jim could've $_{VP}e$.
     b. Kim visited NY but Jim couldn't $_{VP}e$.
     c. Kim visited NY but Jim couldn't've $_{VP}e$.
     d. I'd've visited NY.
     e. *Jim could'ven't seen it.

   There is a vast literature on clitics and many distinctions are drawn; indeed, Arnold Zwicky argued in his later work that there are no clitics (Zwicky 1994). I have drawn selectively from that literature in arguing that the deletion sites discussed so far are clitics. However, it may be that the incorporation analysis of deletion is correct but that the incorporated elements are not clitics; the claims are logically distinct. Thinking of the deletion of copied phrases as cliticization enables us to understand old puzzles about the Fixed-Subject Condition (Bresnan 1972) and the *that*–trace effect of the 1970s, later subsumed under the agreement relations

of Rizzi 1990. It also enables us to learn more about the cliticization operation. In general, subjects resist displacement; when they are copied into a displaced position, odd things happen (for discussion, see Lightfoot 2006b).[11]

Not only do complementizers like *that* and *how* not generally host clitics (see note 11), neither do prepositions. This explains the well-known observation that generally prepositions do not license movement sites: French **Qui as-tu parlé avec?*, Dutch **Wie heb je met gesproken?*, 'Who have you spoken with?'. In English, prepositions may be stranded like this, but only where they are themselves reanalyzed as part of a complex verb, as in (32a) (see Hornstein & Weinberg 1981 for discussion of the reanalysis operation); compare the ill-formed (32b,c), where the PP is not the complement of an adjacent verb (in (32b) it is not adjacent, in (32c) it is an adjunct) and consequently may not host the deleted copy.

(32) a.   Who$_i$ did you $_v$talk + to ~~who~~$_i$?
    b. *Who$_i$ did you talk at the meeting to **who**$_i$?
    c. *What$_i$ did you sleep during **what**$_i$?

I have argued that English speakers *learn* that certain verbs may be phonologically reduced, that complementizers may be null, that *wh-* phrases may be displaced (pronounced in positions other than where they are understood), that verbs may be gapped, that heavy DPs may be displaced to the right, that VPs may be ellipsed, that possessive noun phrases may have objective interpretations. These seven variable properties are readily learnable from the linguistic environment, and we can point to plausible PLD. Such data that all English-speaking children hear include sentences like *Kim's happy*, manifesting reduction; *Peter said Kay had left already* (11a), exhibiting a null complementizer; *Who did Jay see?* (12a), with a displaced *wh-* phrase; *Jay introduced Kay to Ray and Jim Kim to Tim* (14b), an example of gapping; *Jay gave to Ray his favorite racket* (14g), heavy-DP shift; *Max could visit Rio and Susan could, too* (8), an ellipsed VP; and *Jay's picture* (23), meaning 'picture of Jay'.

The way to think of this, I believe, is that children identify certain structures, through understanding and assigning structure to what they experience, that is, through parsing; some of these structures reflect variable properties. Consider the object–verb-order parameter. If we take parsing to be the key, children find either $_{VP}$[DP V] or $_{VP}$[V DP] structures, very specific information. Children use structures or lose them: a child who builds object–verb $_{VP}$[DP V] into her I-language loses $_{VP}$[V DP] structures, which atrophy. Notice that children are reacting to abstract structures, elements of grammar, which are required to understand expressions that they hear; they identify only structures that are unambiguous.

I have argued that an empty element (a deleted phrasal copy, a null complementizer, an ellipsed VP, the ellipsed *dancing* in 20b,c) is incorporated or cliticized onto an adjacent phonological head (N, V, Infl) of which it is (in) the complement. This one simple idea at the level of UG interacts with seven grammar-specific devices, all demonstrably learnable, and that interaction yields a complex range of phenomena. This involves carving up the grammatical world differently.

We seek a single object: the genetically prescribed properties of the language organ. Those properties permit language acquisition to take place in the way that it does, and that means that we must examine language variation along the lines of Baker 2001; that yields a wealth of empirical considerations. Baker analogized parametric options in language to the *elements* of chemistry, claiming that the linguistic options are the basic building blocks of languages. That imputes much detailed information to UG in violation of Minimalist principles. What we postulate must solve the poverty-of-stimulus problems that we identify and solve them for *all* languages as well. We also want our ideas to be as elegant and economical as is feasible. In addition, the grammars that our theory of UG permits must meet other demands.

To take just one example, they must allow speech comprehension to take place in the way that it does. That means that considerations

of parsing might drive proposals. That hasn't happened much yet, but there is no principled reason why not, and the situation might change. Similarly, evidence drawn from brain imaging or even from brain damage might suggest grammatical properties. In fact, the proposals here look promising for studies of online parsing. When a person hears a displaced element, say a *wh-* phrase at the beginning of an expression, she needs to search for the deletion site, the position in which it needs to be understood. The ideas developed here restrict the places where she can look.

Here I have tried to sketch the details of what a good theory of parsing would lead a child to select. We are far from a satisfactory theory, but thinking in terms of how children interpret the contrasts they experience looks far more tractable than seeking to define UG-defined parameters of what constitutes what kind of clitic. The latter would entail postulating very rich information as part of UG, violating Minimalist aspirations.

One uses what looks like the best evidence available at any given time, but that will vary as research progresses, and consequently the form of our innateness claims will vary. There are many basic requirements that our hypotheses must meet, and there is no shortage of empirical constraints, and therefore there are many angles one may take on what we aim for. In this chapter I have taken one angle and progressed beyond where government took us: to delete an element is to cliticize it. This is certainly not the end of any story, but a reasonable way to proceed and an improvement on earlier accounts.