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Finding fundamental operations in language acquisition: Formal features as triggers

Thomas Roeper

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1. Abstraction and Acquisition

The recent history of linguistic theory exhibits a sharp shift to greater abstraction. The shift to abstraction creates a new range of promising and challenging acquisition predictions. We take one goal of all linguistics to be seeking the nature of Fundamental Operations. Whatever the set of abstract operations permissible within Universal Grammar (UG) may ultimately be, we can expect them to be pointedly visible in the acquisition process. A prediction follows:

(1) Abstract Principles predict UG-unique grammars in acquisition.

What weight do the words "abstract" and "unique" carry here? "Abstract" means we should find cases where the child executes an operation which is not representable with typical PS nodes (NP,VP, DP, AGRP). "Unique" means we should find cases permitted by UG, but which do not occur in the language being learned or possibly not in any known adult grammar. This follows if the set of grammars generated by UG is substantially larger than the 3000 known human grammars, which is surely true. The child must generate a grammar compatible with UG, but not a grammar that happens to exist already. (See Roeper (1996) for discussion.)

The advent of minimalism is the most prominent and typical example of more abstract grammars, but all theories which employ a vocabulary with no explicit substantive links, share this abstract character. By "substantive links" I mean again the difference between Phrase-structure rules, which mention traditional "substantive universals" like N,V,A and those which refer only to abstract Maximal Projections. Ultimately, there may be a different style of "substantive" link available to the child: a direct connection between

Pragmatic representations and Formal Features. Such Pragmatic connections are "substantive"[1] because they depend upon an interface with another mental module.

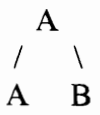
From an acquisition perspective, we are examining such abstract theories by asking the question:

(2) How abstract are the Operations that Children Use?

We will demonstrate that the child Merges Formal Features to create "unique" structures that are a subset of possible UG structures.

1.1 Merge Formal Features

We provide here a brief theoretical introduction, but many of the concepts should become clear from the acquisition examples. Our focus falls upon the operations of Merge, which creates structure, and Formal Features, which are arrayed in bundles in a Numeration. Merge operates on what Chomsky calls the Numeration, which is the lexicon plus critical Formal Features. The Numeration string contains a combination of visible words, morphology, and independent abstract Features. Elements drawn from the numeration form the constituents that undergo a sequence of Merge operations. What is common to all elements that undergo Merge is that they contain Formal Features. Chomsky (1995) defines Merge as an operation which chooses one member of a pair as Head and the other as Specifier or Complement:

(3)


> "..The operation Merge, then, is assymmetric, projecting one of the objects to which it applies, its head becoming the label of the complex formed.....we have only:
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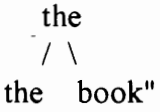
> 
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[1]Categories will be seen, I suspect, as linked to pragmatics.For relevant work see deVilliers (1998), Hollebrandse (1998) and others that involve presupposition and point of view, all of which involve a direct connection between pragmatic reprsentations and internal features of a grammar. Ultimately all of the [+interpretable] properties of Functional.

He notes the possibility of variation across languages:

> "Suppose that the label for $\{\alpha,\beta\}$ happens to be determined *uniquely for* α, β *in language L* (my italics); we would then want to deduce the fact from properties of α, β, from L; or, if it is true for α, β in language generally, from properties of the language faculty. Similarly, if the label is uniquely determined for arbitrary α, β, L as may be the case." (Chomsky 1995)

This in effect articulates the possibility that the set of Phrase-structure nodes may vary from grammar to grammar. Let us translate this into the acquisition process. The child must Merge lexical items in making specific sentences. In creating a grammar from those sentences (either spoken or heard), she must determine possible Mergeable items. The lexical items projected in this manner will contain Formal Features which the child must, somehow, identify, and potentially generalize. In other words, this determination constitutes an abstraction of the Formal Features within the lexical items that are engaged in syntactic relations (such as subcategorization or binding). Once selected a given Functional Category may have a UG-stipulated position in the clausal hierarchy. A simple example is that CP will always dominate IP. It remains an important issue to determine how far the architecture of PS relations are universal, even though, for instance, many languages may fail to instantiate agreement relations inside DP structures.

One form of Feature-identification lies in seeking morphological subparts of words, like [+wh] which are then Formal Features with various properties. Notes that other words (<u>if, how</u>) may share the same Formal Feature, but lack any overt morphology. The Formal Features involve both Lexical (N,V,A) and Functional Features (linked to IP,CP,DP). The Formal Features are carried alongside what we can call Meaning Features which constitute the remainder of meaning in words. The Numeration is the selection made for a given utterance.

(4) Meaning Features:
potentially infinite set <u>not subject</u> to syntactic rules
Formal Features:
a finite set of Lexical and Functional Features <u>subject</u> to syntactic operations

(5) Numeration[2]: set of Formal and Meaning Features available from UG both linked to phonological bundles (words) and abstract.

The expression "subject to syntactic rules" refers to discernible cognitive properties which do enter into syntactic operations. Part of the current research program is then to determine exactly what Formal Features are. Chomsky (pc) has suggested that many of them will be largely semantic. The primary operation is Feature-Checking once they are identified (See Chomsky (1995)).

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[2] See Collins (1995) for an effort to reduce the notion of Numeration to the concept of Select. We do not see a great deal at issue here, but we think the internal character of particular ranges of Formal Features will become important.

It is possible that a given meaning is represented both as a Formal Feature and a Meaning Feature. For example, the notion of reciprocity is present both in the nominal reciprocal and in the anaphor each other. Only the latter allows binding relations. Thus we have binding in (6b) but not in (6a):

(6) a. the boys told the men to illustrate reciprocality.
b. the boys told the men to illustrate each other.

There is no binding in (6a) although the cognitive notion of "reciprocality" is present in a word like reciprocality or reciprocals (or many others like reciprocity, mutual, joint, trade, etc). Does the child know where cognitive "reciprocality" links directly to syntactic binding? This may not be an elementary determination, although it is surely governed by UG interface constraints. The triggering environment for syntactic anaphors will have to have some precise pragmatic dimensions that differentiate general mutual involvement (as in "illustrate reciprocality") and specific parallelism (as in "illustrate each other"). Therefore a Formal Feature [+anaphoric] will attach to one instance of the meaning feature in "reciprocality" but not another. The isolation of syntactically active Formal Features constitutes a significant acquisition problem in its own right.

1.2 Feature Projection and Rejection

If not all Formal Features are selected, then the projection, which is just the set of Formal Features, will vary from grammar to grammar. That is:

(7) Every L selects a subset of possible UG formal Features to be projected in Functional Categories.

A natural example is the feature of gender, which is part of agreement systems in some languages, but not in others. An acquisition sequence, consistent with the Subset Principle, which follows Edwin Williams' proposal (1981) that the acquisition mechanism Maximize Falsifiablility, would be:

(8) Project all possible FF's for a given projection.

That is a child should project:

(9) he sings => -s has gender, number, person

Within hours the child will hear something like:

(10) it fits

which will change that projection to exclude the feminine gender feature or add the neuter feature. When, a few hours later, the child hears he sings, then the gender feature should definitely disappear altogether. Likewise within the nominal projection, the same claim arises. We have in effect the operation:

(11) Project Formal Features:

the [+def, +masc, +acc]
/ \
the man
(masc) (masc)

a. I saw the man
the => the [+def,+masc, + accusative]
b. Ich sah den Mann
den => [+def, +masc, +accusative]

In both English and German, the maximum possible FF's will be associated with the articles (the, den). In German, the generalization will survive, but in English it will be quickly overturned, when the child hears the woman.[3] We shall return below to parallel observations arguments derived from intuitional linguistics below (Chomsky (1995), Thrainnson (1996)).

1.3 Acquisition Theory History

Where do our arguments fit the history of work in acquisition. There have been a number of proposals that children use a Subgrammar (Lebeaux (1990)) or an abstract operation of adjunction (Tavakolian (1978) , Vainikka (1990), Lebeaux (1988, 1990)) or have underspecified Functional Categories (Hyams (1996)), Rizzi (1994), Radford (1990), Hyams and Hoekstra (1995) Clahsen, H. S. Eisenbeiss and M. Penke (1994)). We regard this approach as a further refinement of these proposals.[4]

2.0 General Hypotheses

Our single core hypothesis is that the child never projects PS categories (NP,VP, etc), only Formal Features:

(12) *CP Word [+CP,+ [selectional features], etc]
/ \ / \

If this is true there are a number of specific predictions. In particular a vast range of possible connections are not expected, although they are semantically possible in a general sense. For instance we will not find any random combination of NP V NP:

(13) NP V NP => a.*love did hopefulness
b.*"kick loves foot"

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[3]Of course, matters are never so simple, since grammatical gender and cognitive gender are not necessarily identical. But the first order assumption that they are identical allows the child to eliminate [*the [-masc] woman].

[4]Tracy, R. and E. Lattey (1994) discuss language variation which is another point where abstract operations may be sharply visible.

These sentences are not really semantically implausible. (13b) could mean a foot loves to kick. Thematic features that are immediately associated with give but not with a general category V will prevent a subject like "kick" for the word love or "hopefulness" as an object of did.

Nevertheless our hypothesis predicts both that the child may have generalizations that are both more restrictive lexically and more general syntactically than PS rules would predict. We will show that six predictions are upheld:

Six predictions:

1. Lexical item projects and subcategorizes (why go)
2. Lexical item has no clear traditional PS label (yes)
3. Complement can be very specific (saw wood)
4. Complement can be very abstract (more eat)
5. Lexical item can be a morphological affix (-er)

Before we adduce evidence, note that there are sharp differences between Lexical and Functional categories that may be inherently part of the acquisition assumptions. Funcational Categories are lexically restricted (there are only a few complementizers or tense markers), while Lexical Categories are productive and appear to be significantly guided by category labels (e.g. like takes almost any NP object). If the child knows this as a feature of UG, then it will immediately restrict the generation of new Functional Category entries, while permitting easy additions to Lexical Categories. From an acquisition perspective, this may be one of the primary distinctions between Lexical and Functional Categories.[5]

Lexical categories are potentially infinite and therefore may be automatically generalized or generalized with minimal information. Thus an NP subcategorization for like will label that as an NP, although that can refer to either an object or a proposition (want to go=>I'd like that):

(14) I like hats => I like NP
I like that => [that (lexical item), + Pragmatic Features]
(Pragmatic features = Deictic, declarative,+propositional)

While acquisition research has magnified child grammar, we have not reached the level of detail where we can see the moment of generalization from a specific lexical item to a Formal Feature.

3.0 Evidence for pure Merge: IP-[+NP,+Adv]

We will provide a number of examples where we see Merge in operation, although it may not be completely clear what Formal Features the child has in mind. Brennan (1991) undertook an interesting study showing where children Merge Adjunct Manner

[5]Chomsky (1995) while proposing the eliminatin of AGR as a category, suggests that all Functional Categories may have a semantic connection.

NP, but not with a PP. The PP is, however, present for arguments. The child has therefore allowed:

(15) Merge IP+ NP [+manner] or VP+NP [+manner]

which is not possible in the adult grammar:

(16) Adjunct PP = NP:
we colored crayon (=with)
Shirley get meat dinner (=for)
I cut it a knife (=with)
Richard bring snack Shirley (=for)
I went party (=to)
feed baby fork (=with)
Shirley cut fork (=with)
I sleep big bed (=in)
Save some later (=for later)

(17) Arguments = PP:
I played with Joan
Jim was at Cooperstown
putting Daddy in wagon

She found 46 preposition-phrases that involve Arguments, and only 3 PP's were used for adjuncts in an analysis of 3 of 4 children in the Bloom corpora. In effect the Preposition is seen as an inherent verbal modifier, like a verb+particle construction. It may initially have the feature [+Arg] linked to it, following Maximize FF, which initially would exclude the possibility of an adjunct PP until evidence arrives (non-presence) that it is an adjunct. Brennan's evidence indicates that a child has the capability of applying Merge without a trigger from the target language.[6]

3.1 Specific Lexical Items Project and Subcategorize

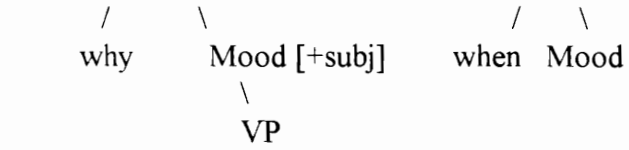
Linguistic theory has long recognized the reality of lexically specific subcategorizations, although no formalism made it a natural part of the grammar or a natural basis for acquistion hypotheses. Consider the following two cases, each of which is honored in acquisition as well. If we assume that CP allows question words as possible lexical items, then we would predict that they will all allow a subjunctive form with no other IP information. But in fact it is only possible with why:

(18)	why go	*where go
	why say that	*when say that
	why be on time	*who be on time
	why not sing	*what not sing

[6]See Penner and Roeper (1997) for extensive discussion of triggers.

We can represent (18) by asserting that [+wh, and +subjunctive] are identified as the crucial projecting, hence subcategorizing Features. Wh-words which lack them do not allow this projection (19b):

(19) a. [+wh.+subjunctive] b. * [+wh]



Infinitives seem to be possible with where to go, what to do but not with why: *why to go. The wh-word what, how their own privileges of occurrence: what about lunch, how about a movie but *when about a movie , *where about a walk. Although young children will use how about and what about, we have found in our searches no known usages of things like *when about.[7] Each example is lexically restricted.

Hale and Keyser (1993) provide evidence (see also Chomsky (1995) that intransitives are really transitive. Thus an expression like: I laugh = I do a laugh which results from raising from a clitic/object position into the do position. However the rule is lexically specific and does not generalize to all objects of do:

(20) a. Not do NP => raises = I did time in jail =>*I timed in jail
b. we did New York => *we New Yorked
c. we did the strawberries => * we strawberried
d. we did the fair => *we faired.

While there are virtually no examples of overgeneralization of this operation with a hidden do, we find that a putatively similar operation, raising to make is a common phenomenon in acquistion in the famous causative cases: "don't uncomfortable the cat", "don't giggle me", etc. Once again, however, even with the causative cases, there appears to be strong, though ill-understood, lexical constraints.

3. 2 Children's Unique Word Projections: Word + complement (=IP)

Akmajian (1973) reports a child who use exclusively are as yes/no question-marker:

(21) "are you put this on me"
"are you get this down" "are you help me"
"are you know Lucy's name is" "are you want one"
"are you got some orange juice" "are this is broke"

[7]See Roeper and Rohrbacher (1994, to appear) for a discussion of many details of how early wh-forms emerge and the special properties of why-questions. In fact there are early examples of where go which suggests that children do not fix this form correctly immediately. However, by shortly after 3yrs only why appears with the bare infinitive.

Note that how come has a variety of special properties as well which suggests that the lexical item directly projects its subcategorization.

"are you don't know Sharon's name is" "are you sneezed"

We find that Modality (are+don't), tense (are+got) and agreement (are+this) information is not being carried by the word are. (See Roeper (1996 for further discussion.) Therefore the word are is more abstract in one sense, marking questions, but still lexically specific and not simply marked with the feature [+Aux] as we find in the target grammar. Stages like this may exist very frequently in child grammar, but without astute diary-keepers, they often go unnoticed because they are short-lived. Crain and Nakayama (1989) were able to find some experimental evidence where children, off and on, used is as a Q-marker. It is surely no accident that in each instance it is a be form, without further meaning, which is misanalyzed as a pure Formal Feature.

Negation shows a similar evolution. We find a stage in both English and German where the anaporic No functions as a sentence modifier. Since negation is a notoriously complex language particular phenomenon, we consider these cases to be the simple result of Merge + IP or Merge + VP. Presumably, substantial reanalysis occurs between this stage and the projection of a NegP that operates as a barrier to wh-movement. Drozd (1992) provides extensive discussion and analysis of these phenomena from a related categorial perspective:

(22) No + complement
No the sun is shining (Bellugi)
no my play my puppet
no lamb have it
no dog stay in the room
No Leila have a turn
No Mommy doing
No have it Mommy (Deprez and Peirce (1992))

The lexical bias comes into sharp relief when we realize that children uniformly use the anaphoric no where the word not will eventually function. The uniformity indicates that the child associates the negative feature with a specific lexical item rather than with the a feature borne by a whole set of items that carry a [+Neg] feature. German shows precisely the same evolution, using nein instead of nicht:

(23) Nein ich putt mache (no I break)
Nein Auto kaput (no car broke)
Nein dieser Messer auaua (no this knife hurt)
Nein Btasch hunger (no uncle hungry)
Nein dick Baby (no fat baby)

This pattern suggests the presence of an acquisition procedure (that we do not understand) which turns a discourse element (no) into a sentential modifier:[8]

[8]This observation goes back to Bellugi (1969) and it has been discussed in Felix ( ) and Roeper (1992), and at length in Drozd (1994).

3.3 Lexical Adverbial Projections

Tracy, Penner, Weissenborn (1994) identify an intersting stage in German where the adverbial form auch(also) appears to have a strict 2nd position but with a variety of complements:

(24) Stage 1: X auch ("toto auch". "ich auch", "hauschen auch")
[x also] (toto also, I also, house also)

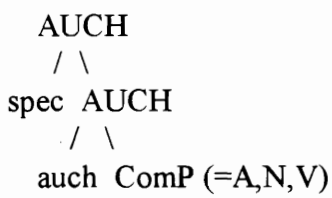
Stage 2: subj AUCH DO "stephanie AUCH Nase" (Stephanis also nose)
adv AUCH subj "das auchn RŸssel" (that also a Russel)
subj AUCH adjective
Subj AUCH DO
Subj AUCH V-infin "nina o cho" = Nina auch come

Stage 3: X V-fin AUCH Y "klebe das auch noch klebt "
"macht des auch macht"
(make it also make)

Powers (1996) finds the same pattern in Dutch:

(25) "pappa ook zitten dar" (papa also sits there)
"papa ook eten" (papa also eats)
"ik ook sokke uit" (I also socks off)

The pattern suggests that the initial position is defined as a lexical projection, with a Spec, rather than with any phrasal category:

(26)


The child, somehow, then reanalyzes the adverb as the Spec of an Adverb phrase, when the V-2 position is occupied by a verb. Until that point, one might argue that that auch carries a V-feature itself (equivalent to do,have, or be). Before real V-2, the children place the verb in the root infinitive position, suggesting that the auch in V-2 blocks movement. The child's grammar, however it is formulated, has a lexical link.

3.4 Complement Projection => Word

While the previous example exhibits an abstract Spec and Complement with a lexically specific Head, there is also evidence that children project a lexically specific Complement. Nygren (1972) did an intriguing study of how children define verbs. While adults link verbs to a style of motion, children initially link them to an object or an instrument. Here are answers to some of her questions from 6yr olds which carry the implication that the verb saw requires that you saw wood with a saw:

(27) Can you file wood with a saw
"No because you cannot file wood"
Noun prime: Can you saw cheese with an ax?
" No you must saw cheese with a saw"

The child then presumably must generalize the complement of saw:

(28) saw wood => saw [+NP, +concrete]

Such narrow stages of acquisition are virtually impossible to see in the naturalistic data since they always involve grammatical sentences. Nonetheless, word-specific complements may capture the first, brief stage for all verbs.

Here we can underline the mystery which is now evident in Minimalism: What are the conditions for generalization? When does a child decide that a Spec or Comp should be extended to any word that contains a certain Formal Feature? We return to this question.

3.5 Lexical Items without Phrasal Category

There are numerous words which have no clear categorial definition. It is obvious they are easily acquired because early utterances are sprinkled with them. Here are cases all found within the grammars of 2yrolds:

(29) a.yes ,no, well, but, so, and
b. "OK, night-night, lemme, upsiedaisy,
c. "well but they red like those" (Adam).

Consider now the adverbial form well, or but which functions as a vague discourse connector in expressions like (30a,b).

(30) a. well, I can
b. but I can
c..*I can well
d.. *John has a hat but

Note that, unlike other adverbs, they do not appear at the end of sentences (30c,d). The semantics of such expressions, like "but" or "uh-oh" (expected problem), or are unusually complex inasmuch as they contain a sophisticated notion of possible worlds. The fact that children grasp them easily suggests that the internal semantic structure of individual words are not compositionally acquired, although how larger chunks of meaning are available to a child remains extremely unclear.

3.6 Case Study of "yes" in English, Spanish, and German

A more interesting question arises when we consider cases that involve language variation. Affirmative phrases, which receive a separate projection Affirmative-Phrase in

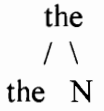
the analysis of Laka ( ), show considerable langauge variation. Let us first assume that the child immediately identifies a [+Aff] Feature, which in the clausal hierarchy could lead to this structure: CP AFFP IP. The set of words that should acquire this feature include: yes, uh-huh, indeed, sure. Note that they have distinctive differences in distribution: (b) cannot appear sentence-internally. And they differ in whether they take an emphatic stress, where "yes" groups with indeed, sure which do appear internally:

(31) Adult: a. I sure can/I indeed can sure, indeed, yes => [+stress]
b. *I yes can/*I uhhuh can uh-huh => [-stress]

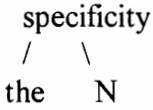
1. (a) if syntactic => should generalize to (b)
2. (a) if semantic => should generalize to (b)
3. (a) if lexical => should not generalize to (b)

For comparison, consider three comparable ways that articles could project:

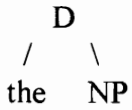
(32a) lexical



(b) semantic

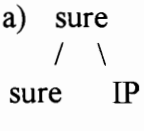


(c) syntactic

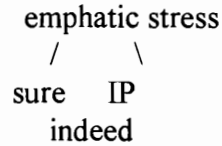


Now the parallel set exists for the Affirmative Phrase, where we consider "emphatic" to involve a semantic feature:

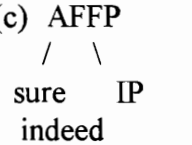
(33a) sure



(b) emphatic stress



(c) AFFP



Each definition beyond the word predicts overgeneralization. In fact, these forms show language variation, since Spanish allows si to appear sentence-internally:

(34) English: a. yes I can/I know that he can
b.*I yes can/*I know that yes he can
Spanish: c. yo si.... (I yes...)
d. ....que si (that yes....)

And German allows post-auxiliary ja (ich kann ja singen) but nothing that appears between subject and auxliary: *ich ja kann. Our prediction here is that English, Spanish, and German children will not overgeneralize if their grammars are word-based because they would only extend the distribution of a word on the basis of positive evidence (hearing the word in a new position). This hypothesis is, prima facie, too restrictive because it would exclude all generalization on the basis of Formal Features. Nonetheless it is clear that child and adult are capable of lexically specific projections, which are the natural starting point. It is possible then that our three models of Merge represent progressive stages in acquisition.

With the help of Ana Perez and Susan Powers I have assembled the following examples from English, Spanish, and German. (Pet = Peter, Nin = Nina, etc) (# = a pause):

*PET: it's yes its is [!!] going away .
*PET: beaver # yep # it's a beaver # yes that's right there a beaver #
*PET: maybe yes .
*MOT:I'll go for a while # yes .
*PAT: oh yes he will # in about five minutes !
*PET: yes # hear that noise ?
*PET: in here yes I wan(t) (t)a play with them again.

These examples reveal how extraordinarily complex and obscure the surface of language is, both to and by the child. Most utterances have some properties of ellipsis. False starts, added exclamations, easily give the impression that yes could appear sentence-internally. Nevertheless, there are no occasions in all of the data that we searched where we found a form like *"I yes can. [*" = unattested].

By constrast, in Spanish, we find that 3-4 yr old children will immediately begin using "yes" in these restricted positions:

*Nin: yo si puedo ja he comido lechuga = I yes can, already have
*NIN: Oscar si pea = Oscar yes peels
*NIN: Oscar si pea .
*NIN: que si # que no = that yes that no (that=comp)
*NIN: no # eso si mio = no that yes mine
*Nin: porque si = because yes
*Nin: a ese si = to that - one yes
*Nin: oyee si hay monos alla alla elo no hay monos
= Listen yes there-are monkeys there.....
*NIN: a en miro si = to him look yes ' I do look at him'
*NIN: y ya vienen ardillas # a que si .
and already squirrels come#"a que si" = to that yes,
*Nin: de pequeno si a que si = when little yes, you will see

In German we find no instances of *ich ja kann but numerous instances of post-verbal ja:

*SIM:= ich puste mal ja -' . (I clean once jyes)
*SIM:= ja ich zeig xxx . (yes, I show)
*SIM:= ich teile ja (I share yes)
*SIM:= bonbon habe ja -' .(bonbons have yes)
*SIM:= saft habe -_ ja -' saft habe -` saft habe -` .
(juice have --yes--juice have)

Ja may occur in medial positions:

*SIM:= geht ja gar nicht (goes yes not at all) .

or between verb and object:

*SIM:=hat ja nun kein # (has yes now none).
*SIM:=hat ja nun kein Hnschen mehr (has yes now no chicken more) .
*SIM:= aber mama weinet sehr hat ja nun kein [/] .
(but mama cries much has yes none)
*SIM:=doch der kann ja eine nuss essen (so he can yes a nut eat)
*SIM: das ist ja viel zu wenig - (that is yes much too little)

It is evident that in Spanish there is swift recognition of a non-initial potential for "si", and in German there is swift recognition of the VP-internal "ja", but none in the Spec of IP, while in English neither ever occurs. At some point productivity arises, and this property remains a mystery. The child associates a feature [+AFF] with the second position, as suggested by Laka (1991), and the position is open to any word which obtains this feature. Presumably German has several +AFF positions. We predict the following sequence:

(35) a. Child starts with lexical item,
b. then identifies Formal Feature =>
c. FF becomes MP-label or phrase head

3.7 Abstract Subcategorization

Powers (1996) and Lebeaux and Powers (1997) have identified examples where children appear to generalize beyond the lexical categories to the equivalent of a category-free XP:

(36) more hot, more cereal, more read, more sing, more high, more walk (Braine 1976)

It appears that the child takes XP as a possible object, which means that it is not limited to, say NP, nor to a particular word (say, milk), nor to a phonetic object ("milk"):

(37)
```
          more
          /  \
more      X (=N,V,A)
            *NP
            *word (milk)
            *"milk" (phonetic object)
```

Since the child is never exposed to move+V ("more walk"), it must be a generalization from the observation that more can occur with both adjectives and nouns.

(38) Hypothesis: more word => more [+NP] => more [+AP] => more [+XP]
more [+NP,+AP => XP]

Lebeaux and Powers (1997) offer the interesting hypothesis that an abstract Event feature could be a unifying Formal Feature in this domain where an expression like "more

high" could mean not "higher" but "push swing again" or more [+Ev].[9] This is just the kind of analysis which a theory of Formal Features, directly linked to pragmatic perceptions, invites. That is, the child perceives in a situation not only the fact that an object moves higher, but that an imperative is involved and an Event occurs. This leads us to the hypothesis that situational, or pragmatic observations are directly linked to Formal Features without an intermediary category determination:

(39) a. Pragmatic observations trigger Formal Features
b. FF can be linked to any Lexical or Functional Category

The last hypotheis is much too strong and must be constrained. However the domain of constraints looks different from the traditional ones. In effect UG must state constrained triples where: Pragmatic representations, Formal Features, and possible Category projections are limited.

3.8 Morphological Node Head: -er Affixation

We have utilized the word as a position from which unique subcategorizations can occur. However it is logically possible that the child uses an affix as the basis for subcategorization. There is anecdotal evidence for [VP+er] which I have collected:

(40) "I'm not too much a player with him" [=(play with him) -er]
"there's a bike-rider with no hands" [= (ride bike with no hands)-er]

In an experiment by Janet Randall (1983), she demonstrated that children initially interpret verbal suffixes as if they had scope over the entire VP even if they function as a verb affix. She gave children agents that either had (dancer) or lacked a verbal base (ballerina) and asked them to choose pictures to match:

(41) a. a chef with a fork
[chef uses a fork/chef has a fork]
b. a writer with a candybar
[writes with a candybar/ has a candybar]
c. a ballerina with a tutu
[ballerina sits with a tutu/dances with a tutu]
d. a dancer with a tutu
[dancer sits with a tutu/dances with a tutu]
=> only one dancing, not wearing tutu

Children, roughly of six years, gave exclusively a VP construal 82% of the time (Randall (1983)), to those with a verbal base. Thus only (41b) was necessarily associated

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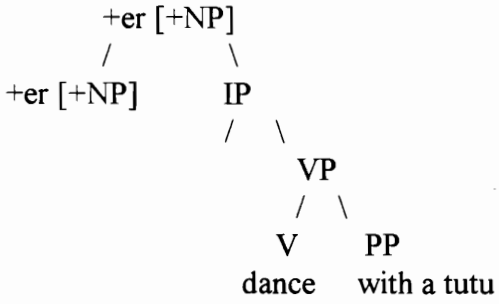
[9] See also Tamanji (1997): whose study of adverbs shows that their distrubition is controlled from the outset in acquisition by lexical restrictions and subtle Mood features. Thus he finds:
i) "I can do it real fast"/"*"I fast can do it"
"I never seed a funny man"/*"I seed a funny man never"
Thus we conclude that the child begins with a complex of Formal Features:
[ADV,+Neg] or [+Adv, +Mood] for expressions like sure, certainly.

with an action of writing (even though writing with a candybar is unnatural and cooking with a fork is very natural).

We can represent this relationship as a Head-Complement relation, following (Borer (1994) Fu, Roeper, Borer (1997)), where dance raises to the higher nominal position. (42):

(42)



We have presented a set of vignettes which raise deep theoretical questions. Does every affix begin life as the Head of a Maximal Projection? This seems unlikely and in fact there is evidence that children and adults have a more primitive version of -er affixation which allows expressions like Detroiter, New Yorker, and related forms like author, anchor. Now we must ask exactly what triggers the Spec-Comp projections on a productive basis? The fact that one can say author of the book but not *poet of the book suggests that it is not simply a semantic relationship (verb+complement) which functions as the trigger, but a joint recognition of a semantic relation and a phonetic link which comprises a trigger. In other words, we expect that the triggers of productive processes are inherently "complex" and cross-modular in line with Chomsky's observation that the child uses "triggering experience".

4.0 Conclusions

Every piece of early acquisition data is rife with ambiguity. One cannot be sure that an adult meaning or category is intended. Our approach to this problem is to assemble an overwhelming variety of facts which collectively point toward abstract operations, even though, in many instances we remain unsure of the precise Formal Features involved.

Each discernible moment of acquistion is relevant to the determination of abstract operations. They have three prominent characteristics 1) no coherent stage may be evident, and 2) these operations that deviate from target grammars may be repeated throughout the acquisition process, 3) evidence for abstract operations may be extremely brief in duration.

We have argued that those abstract operations do not indicate the presence of simple category projections, but rather for a more subtle array of differentiated features, present from the outset of the acquisition process. What does the aquistion process display? A child rapidly follows a process of:

(43) a. Merge Word
b. Project Word with Spec and Comp

c. Extract and Project Formal Features

How can we constrain the process so that every semantic distinction does not function as a Formal Feature? The answer to that question lies in determining (a) an inventory of universal Formal Features, and (b) hierarchical and implicational relations among Formal Features that will restrict the hypothesis space considered by the child. This is the major current challenge to both linguistic theory and acquisition theory alike. It is perhaps in a microscopic analysis of child grammar that the best insights into these problems are obtainable.

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