Recursion as an Analytic Device in Acquisition[*]

Thomas Roeper[1] and William Snyder[2]
[1]University of Massachusetts, [2]University of Connecticut,
and [2]Haskins Laboratories

1. Introduction

The child's linguistic input often includes evidence for incorrect grammatical analyses. For instance, the child acquiring English will hear sentences such as "Here comes the train," but English is not in general a V2 language. How does the child know which evidence to trust?

Could one V2 sentence shift a major parameter? Or perhaps block a child's progress, because the input contains an unresolvable contradiction? Although classic learnability theory assumes that a single example can suffice to change a parameter, we argue that there has to be a method to filter out certain sentences. Otherwise, the child will be paralyzed by contradictory (e.g. V2 and non-V2) input.

In this paper we propose that recursion plays a central role in the differentiation of "exceptional" domains from truly productive grammar. As argued by Hauser, Chomsky and Fitch (2002), recursion is the central characteristic of core grammar. Our proposal is that recursion tells the child when a productive, grammatical operation has applied.

2. Nominal compounding

For example, both English and French employ nominal compounds such as *frog man* or *homme grenouille* (literally 'man frog', for 'underwater diver'). Yet, only in English is there a productive grammatical process of nominal compounding. Correspondingly, only in English is it common to find recursive nominal compounds:

(1) a. [frog man]
    b. [[frog man] team]

(2) a. [homme grenouille]
        man   frog
    b.?* [équipe [homme grenouille]]
        team   man   frog

Two-term compounds such as *homme grenouille* are readily stored as frozen forms in the lexicon, but in the vast majoity of cases, compounds of three or more terms are the result of a recursive compounding operation.

On our proposal, hearing a nominal compound <u>within</u> another nominal compound is what tells the child learning English that nominal compounding is a productive operation. Roeper, Snyder, & Hiramatsu (2002) have shown that three-term compounds (e.g. [[*Christmas tree*] *cookie*]) are robustly present in the input to English-learning children, and could indeed be the basis for deciding that root compounding is a productive grammatical process in English.

Next we examine a mirror-image case: How does the child acquiring English <u>resist</u> the temptation to analyze English as allowing Serial Verb Constructions (SVCs)? Our proposal is that utterances in the English input that resemble SVCs lack the crucial property of recursion.

3. Verb serialization

Some of the world's languages are "serializing," and permit SVCs. Examples from the creole language Sranan (Baker 1989, after Jansen, Koopman, & Muysken 1978) are provided in (3-4).

(3) Mi e **teki** a nefi **koti** a brede.   (Baker, p.537)
     I   Asp **take** the knife **cut** the bread
     "I cut the bread with the knife."

(4) Mi **fringi** a batra **broko**.   (Baker, p.516)
     I   **throw** the bottle **break**
     "I threw and broke the bottle."

Baker (1989) argues that serializing languages allow both "Serial Verb Constructions Proper" and "Covert Coordination." The general characteristics observed in both constructions are given in (5).

(5) Characteristics of Serializing Languages:
     a. Allow a sequence of verbs to appear within a single clause;
     b. The verbs share a single structural subject;
     c. The verbs *may* share internal arguments.

At this point we encounter the learnability puzzle: How does the child acquiring a non-serializing language such as English resist the temptation to posit serialization? The temptation will come from examples like those in (6).

(6) a. Sue can **come eat** lunch now.
     b. John should **help** Mary **clean** the house.

In (6a-b), two verbs appear within the same clause, are interpreted relative to the same Tense head, and (plausibly) share a single subject. (In (6b), treating John as a co-agent of cleaning will be fully consistent with the sentence's truth conditions.)

The verbs do not share an internal argument, and therefore cannot be analyzed as Serial Verb Constructions Proper, but they can still be analyzed as examples of Covert Coordination.[1]

Nonetheless, children with English input grow up to be adults who disallow serialization as a productive grammatical option. This can be seen clearly from the ungrammaticality of examples like (7).

(7) * Mary should **take** the knife **cut** the bread.

How does the child decide? On our proposal, the basis for the decision could be the absence of <u>recursive</u> serialization in the input. To see what recursion would look like, consider Baker's (1989) analysis of serialization.

For Baker, serialization involves the syntactic composition of two separate V projections (with separate V heads) into a single VP. This is illustrated in (8), where the topmost V' takes both a V and another V' as daughters.

(8)   **V'**
                   / | \
             V (NP) **V'**

In a serializing language such as Sranan, this operation can apply recursively, to yield a VP with three or more V heads, as in (9).

(9)   **V'**
                   / | \
           V/V' (NP)   **V'**
                         / | \
                  V/V' (NP) **V'**

Our proposal, then, is that the child refrains from positing serialization as a grammatical option until encountering an example like (10) (with three or more verbs).

(10) Kofi [**fringi** a tiki [**fadon** [**naki** Amba]]].   (cf. Baker p.550, after Sebba 1987)
     Kofi **throw** the stick **fall hit** Amba
     "Kofi threw the stick down at Amba (and hit her)."

A problem, however, is that even in English there can be examples with three or more verbs, such as "John will **go help** Mary **cook**". Indeed, the truth conditions for this example are compatible with the typical "conjunctive" semantics of an SVC: John will go, and he will help Mary, and Mary will cook. Yet, while three-term

---

[1] One might question whether the child acquiring English will ever receive input that could be misanalyzed as a Serial Verb Construction *Proper*, with a shared internal argument. Causatives could, in principle, yield such cases: For example, the sentence *John made the vase break* could, in certain contexts, be misconstrued as an SVC Proper meaning "John made and broke the vase."

examples of this type are grammatical, they will pose a problem for our learnability account *only* if they are robustly present in the input. The question, then, is the frequency of such examples in child-directed speech.

4. Case study: Naomi

A case-study of maternal input to the child Naomi, in the Sachs corpus (Sachs 1983, MacWhinney 2000), indicates that such three-term examples are *not* present in sufficient quantity to confuse the English-learning child.

The Sachs corpus contains samples of mother-child interactions from the time the child is 1;1 to 5;1, and includes some 8,843 maternal utterances. We hand-coded all maternal utterances containing one or more of the following verbs, each of which permits a small-clause complement: *come, go, see, hear, watch, help, make.* For each such utterance, we asked: Could the child interpret this as a two-term SVC? As a three-term SVC?

Our results were that 47 of the mother's utterances could be interpreted as containing a two-term SVC (for a frequency of about one such utterance per hour of child-directed speech). Representative examples are provided in (11).

(11) *MOT: **come look** at the picture of the horse .
     *MOT: want to **go see** the snow ?
     *MOT: you **watch** Mommy **clean** .

Yet, no utterance (in approximately 50 hours of child-directed speech) could be interpreted as an SVC of three or more terms. Hence, clear evidence of recursive serialization is plausibly what the child requires, before deciding that the language allows serialization as a grammatical option.[2]

5. Adjectives

Our discussion thus far has considered recursion with nouns and verbs. If they are representative of a larger class, then we predict that the remaining lexical category, adjectives, will pattern in the same way. Attributive adjectives in French are an ideal testing ground. Single adjectives can sometimes appear before the noun (12a), but recursion is normally postnominal (12b):

(12) a.   *une belle chemise* "a beautiful shirt"
     b.   *une chaise ronde rouge* (lit.) "a chair round red"

On our proposal, the French child could rely on evidence of recursion to decide whether a given position (prenominal or postnominal) is routinely available to attributive adjectives. A prediction is that child-directed French should be free of

---

[2] As pointed out to us by Harald Clahsen and Kamil Ud Deen, an important, as yet untested prediction is that the child-directed input in serializing languages (such as Sranan) does indeed contain examples of recursive serialization, with three or more verbs. We do not, at present, have the means to test this prediction.

the exceptions (multiple prenominal adjectives) found on rare occasions in adult French. As reported in (Snyder & Roeper, to appear), this prediction appears to be correct.

6. The forms of recursion

Now we can consider a larger question: Is the acquistional role of recursion limited to the lexical categories? In fact, recursion is present in many domains of grammar, each of which makes special demands on the child. Here we briefly sketch a larger framework. It remains our goal to explore this framework in more refined empirical and technical detail.

The first question to ask is where we can see recursion on the surface of language. With this information we can imagine the path that the child takes in identifying recursion. A child will most probably use phonological identity as a first clue: *and….and…and* at the sentence level, or the presence of duplicated morphemes (*re-re-re-read*) at the morphological level. Recognizing categorial recursion, of the kind discussed in the previous sections, will be the next demand on the acquisitional system.

Here it is useful to have a simple overview of some grammatical domains in which recursion appears. At the level of sentences, recursion is found in every grammar: Every language allows the embedding of one sentence inside another. Yet, certain forms of sentence recursion are subject to cross-linguistic variation. In languages like English we find embedded relative clauses on all NP's. In other languages, though, relatives are permitted on objects but not on subjects.

At the inflectional Level, German allows multiple modals, but English does not:

(13) Er muss singen können.
     he must sing   can
     "He must be able to sing."

At the verbal level, verb complementation is present in every language, but there is substantial lexical sensitivity. At the prepositional level, English has recursive prepositions, as in *John walked on out the door*, but these are not present in all languages. Prepositions also must be differentiated from particles, which are are not directly recursive. Finally, at the determiner level we find that Greek, for example, allows the repetition of articles on adjectives. Marinis (2000) shows that this is recognized by children very early:

(14) Christos 2.8:
     Pu   ine i mavri i   ali   i   boghia?
     where is the black the other the colour

As discussed by Eisenbeiss and Roeper (2001), inflections inside the determiner system engage recursion in yet another way, and their proper representation constitutes a challenge to both the linguist and the child. Numerous other, entangled forms of recursion are found in the languages of the world, at every level of grammar.

At present one distinction strikes us as especially important: Recursion can be either <u>direct</u> or <u>indirect</u>. The lexical categories typically allow <u>direct</u> recursion:

(15) AP → A (AP)

Sentence recursion, however, is typically <u>indirect</u>, in the sense that another type of node intervenes. Stated in terms of traditional categories, the sentence (S) does not directly generate another sentence, but rather a VP within which S recurs:

(16) S → NP VP
     VP → V (S)

This distinction looks important from the perspective of learnability, because the difficulty of recognizing the recursion will plausibly be greater for indirect recursion. Here we provide a brief case-study that illustrates a few of the crucial concepts.

Alongside (17a), which would correspond to simple case-assignment in some languages, English allows recursive prenominal possessives, as in (17b).

(17) a. John's house
     b. John's friend's sister's house

German disallows such embedded genitives. Yet, it does allow the genitive, as a case-marker, to recur within a DP on both the determiner and the noun, as in (18).

(18) des   Mannes
     "the's man's"

How does the child determine that English has true recursive possessives, while German marks one inflection in two places? One clue lies in the scope properties. If we point to "my friend's sister's car," a child can see that it is not "my friend-and-sister's car," for example. It follows that each –s morpheme marks a separate possession relation. Their order indicates their (recursive) embedding relation, and hence, their meaning relation.

Another indication to the child could be hearing a sentence like (19), which shows that the possessive applies to an entire phrase, and therefore must permit indirect recursion:

(19) [the man on the corner]'s hat

We can capture the indirect relation through phrase-structure representations, as in (20).

(20) DP → Spec [D [N (PP)]]
     D   → 's
     Spec → DP

The indirect recursion allows an entire phrase to appear inside the possessive, which can then include another possessive:

(21) [[my friend]'s sister]'s car

Attention to the context, and thus to the likely interpretation of such utterances, will (eventually) allow the child to recognize the recursive phrase structure. This recognition is what will allow the child to differentiate English possessives from the German type.

Our approach now makes a prediction for English possessives: Young children will succeed at single possessives, but will resist recursive possessives until there is sufficient evidence of recursion (cf. 17b, 19) in the input. We thus predict a stage in which the child can comprehend or produce only a single possessive. More generally, we predict that children will initially resist indirect recursion.

There are virtually no examples of English-learning children using recursive possessives, and there is clear evidence that they have difficulty understanding them. Below we provide a few representative examples from Brown's (1973) data for Sarah.

MOTHER: that's like um what's Auntie Marian's doggie's name?
what's Auntie Marian's puppy's # dog # name?
what's <u>Auntie Marian's</u> <u>puppy's</u> name?
SARAH: (unclear)

MOTHER: huh?
what's your… what's….what's <u>your</u> cousin <u>Arthur's</u>
<u>Mummy's</u> name?
SARAH: I don't…..
your cousin ?.

MOTHER: yeah, Arthur… Arthur… what's <u>his</u> <u>Mumma's</u> name?
SARAH: I want pin.

7. Conclusions

Universal Grammar allows many different grammatical structures, but any given language permits only a subset of them as productive options. Evidence of recursion is an excellent indication that a particular structural option is indeed productive, rather than an isolated exception. Moreover, case-studies of nominal compounding, verb serialization, and attributive adjectives indicate that evidence of recursion in child-directed speech corresponds closely to the options that are in fact productive in the adult language. Finally, in the case of English possessives, the distinction between direct and indirect recursion corresponds to points of grammar that are mastered early versus late. Our conclusion is that evidence of recursion plausibly plays a central role in the child's acquisition of grammar.

References

Baker, M. (1989) 'Object sharing and projection in serial verb constructions'. *Linguistic Inquiry* 20, 513-553.

Brown, R. (1973) *A First Language: The Early Stages*. Cambridge, Mass.: Harvard University Press.

Hauser, M.D., N. Chomsky, and W.T. Fitch (2002) 'The faculty of language: What is it, who has it, and how did it evolve?' *Science* 298, 1569-1579.

Jansen, B., H. Koopman and P. Muysken (1978) 'Serial verbs in the creole languages'. *Amsterdam Creole Studies* 2, 125-159.

MacWhinney, B. (2000) *The CHILDES database: Tools for analyzing talk. 3rd Edition. Vol 2: The Database*. Mahwah, New.Jersey: Lawrence Erlbaum Associates.

Marinis, T. (2000) *The Acquisition of the DP in Modern Greek*. Doctoral dissertation, University of Potsdam.

Roeper, T. and W. Snyder (in press) 'Language learnability and the forms of recursion', in: A.M. Di Sciullo and R. Delmonte (eds.) *UG and External Systems*. Amsterdam: John Benjamins.

Roeper, T., W. Snyder and K. Hiramatsu (2002) 'Learnability in a Minimalist framework: Root compounds, merger, and the syntax-morphology interface', in: I. Lasser (ed.) *The Process of Language Acquisition*. Frankfurt: Peter Lang Verlag.

Sachs, J. (1983) 'Talking about the there and then: The emergence of displaced reference in parent–child discourse', in:.K.E. Nelson (ed.) *Children's language,* Volume 4. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Sebba, M. (1987) *The Syntax of Serial Verbs*. Amsterdam: John Benjamins.

Snyder, W. and T. Roeper (to appear) 'Learnability and recursion across categories', in: A. Brugos, L. Micciulla and C. Smith (eds.) *Proceedings of the 28th Annual Boston University Conference on Language Development*. Somerville, Massachusetts: Cascadilla Press.