Locality constraints imposed by acquisition frames

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1   Input-controlled acquisition and locality

This paper reaffirms that "Locality" is the major orientation in grammar (Emonds, 1985; Chomsky, 2001; among others). The universal locality restrictions in human grammar follow from the way language acquisition operates (cf. Wexler and Culicover, 1980). This is not meant as a particularly profound insight. There is very little else for an initial acquisition procedure to adhere to. Structures for stress rules, abstract categories, or empty categories, let alone underlying representations and transformations may be innate or not, they cannot be applied until there is some grammar. Initially of course, there is no grammar yet, since the acquisition procedure is still on its way to find one out.

Longitudinal analyses of child language show how the child adds grammatical markers within preceding binary frames and how each syntactic acquisition step relies on such a preceding binary frame. These preliminary acquisition frames - which we will call here evidence frames, following Van Kampen (1997) - testify of a prehistory in which they were the origin of an acquisition step, i.e. the rise of a new functional feature. This perspective on syntactic locality is summarized in (1).

(1)   a. all acquisition frames, c.q evidence frames, are based on a local adjacency in binary structures
         b. all marking by grammatical features is acquired with respect to such acquisition frames
         c. all locality restrictions between grammatical markings derive from such acquisition frames

The acquisition frames indicate that grammar is caused by input. The order of learning steps demonstrates that typological properties are the first ones to be acquired (as predicted by Jakobson, 1942). This will lead us to the idea that abstract grammatical principles may result from a self-organizing learning procedure. Universal Grammar (UG) and its typological effects may be an outcome of the acquisition procedure rather than its source. The growth of the evidence frames can be studied by analyzing the linear order of the successive expansions in the child's syntax. The key issue is to explain the linear order in the acquisition steps.

2   Order of acquisition steps

It has never been disputed that language acquisition depends on a certain amount of input-control. Yet, it has so far not been a research priority in generative grammar to see how the appropriate input could be selected, what pre-existing grammar it could affect, and whether the order or the speed of the acquisition steps could be predicted.

The procedure for first language acquisition is not confronted with all possible grammatical problems at once. This is not even possible. The somewhat more complicated problems cannot become visible unless distinctions are made between several domains and categories. Before discussing whether some grammatical property can be acquired, one must agree upon which part of the grammar is already available to the learner. We propose that the young learner is unaware of the grammatical alternatives that are available in the world outside (cf. Culicover and Nowak 2003). Suppose the child has reached a point at which he is able to recognize separate words. Automatically, the child will ignore all functional categories, like articles, auxiliaries and verbal inflections, since these cannot be interpreted without grammar and grammar is still absent. What remains is a limited set of lexical content words that are learned as names and characterizations in actual situations. Our young learner, not informed by an innate

UG, must reduce its initial attention to constructions assigned to pairs of adjacent content words to make some sense of it, and so he enters a maximally reduced observation space. We propose therefore that the acquisition procedure applies considerable reductions on the input data. Suppose the acquisition procedure starts with the reduction operation in (2).

(2) *Input Reduction*
   a. make a distinction between grammatical markings and content words by their difference in frequency
   b. substitute the notation $<+F,?>$ for each grammatical marking that is still unknown
   c. throw out all input sentences with more than one $<+F,?>$ category

The intake to the acquisition procedure under these restrictions is now such that one grammatical category is singled out, identified and subsequently acquired. The acquisition of the former category $<+F_i?>$ changes the data reduction procedure. The next grammatical category $<+F_{i+1}?>$ is singled out, etc. In section 4 we will present acquisition data that support the reductions in (2).

3   Locality and blocking

Language acquisition must avoid or redress overgeneralizations and undergeneralizations. It has two major tools at its disposal. The locality restriction and blocking.

Language acquisition proceeds by adding grammatical features within a local binary frame. A learning procedure that adds a grammatical feature to a category moves from a less restricted superset to a more restricted subset. The learning procedure starts with overgeneralizations, but the associative pressure of local contexts has a limiting effect. The combinations narrow down to the phrasal form that fits the lexical head. The initial overgeneralizations are "blocked". Blocking effects are known from the very beginning of grammatical studies. Irregular inflection forms are said to block the regular ones. The initial option that allowed *she gived the apple* and *she gave the apple* is reduced to the latter. The acquisition procedure eliminates the option between a less specified and a more specified variant. In general, the more specified variant blocks the less specified one. The acquisition procedure will add the lexical specifications as grammatical features if they are present in the input sufficiently early and sufficiently robust. Blocking is a procedure over time and the more specified variants compete for some time with the earlier and less specified variants. Blocking is more an effectiveness device. It never works instantaneously. It takes some time and some quantification before one realizes the more effect use of the devices. Van Kampen (1997, 2004) for an analysis and examples.

The blocking procedure is also effective outside morphology. For instance, the Dutch input offers the young learners about 25% VO (Verb-Object) patterns and about 75% OV (Object-Verb) patterns. The latter is largely due to a quantitative amount of auxiliaries and modals in the input. At a very early stage of development the 75% OV pattern wins the competition and the VO patterns get marginalized. The lexicon of content words establishes a strong preference for OV patterns. See Evers and Van Kampen (1992, 2001) for an acquisition procedure driven by input quantities that reconstructs the Dutch SOV order and V-2nd rule.

The natural locality restriction in acquisition allows the overgeneralizations followed by blocking. The domain restriction itself is an immediate safeguard against domain over-generalization. Grammatical specifications like reflexivization and wh-movement in Dutch child language will not appear before there are finite verbs and finite verbs will not appear regularly before theta frames are established (Van Kampen, 1997). Subject-verb agreement, reflexivization and scope of $<+wh>$ are learned with respect to the local IP. The later embedding of for example an infinitival IP within a matrix IP, does not alter the strictly local character of the IP internal markings that have been acquired before. Long reflexivization and long wh-movements are possible in some languages, but their acquisition is late, and the domain extension invariably require specific head-head restrictions between the embedded and the embedding IP. See for the acquisition of long wh-movement under local conditions Van Kampen (1997).

4 Evidence from acquisition

Initially, our learner leaves out all grammatical marking that is still unknown. This reduces the attention to constructions assigned to pairs of adjacent content words. One of these content words must be recognizable as a name or a characterization of something obvious. The other often announces the intention of the utterance {*want bear*; *bear away*; *where bear?*; *that bear*). The proto-grammar of operator-content word allows an extension of the lexicon. The young learner seems to reconstruct his data so as to fix them into this minimal template. The reduction of the data set to constructions within the range of the current grammar is an important point. A combination of two content words yields a binary topic+comment construction {*bear* (is on the) *table/*(has) *fallen/*(is) *sweet*} the characterizing comment of the binary topic-comment structure may be marked by a copula or some other auxiliary element. At a certain moment the marking of the comment by a functional element becomes systematic.

Systematic marking of the characterizing content sign seems to be the first grammatical step that the child reconstructs to approximate the input. Subsequently, the topic part is marked as a referential sign. These two steps, marking characterizing signs as predicates and marking topic names as referents, are clearly separated. Each of these two steps is accompanied by another significant acquisition step. I-marking, i.e. the marking of the predicate by a {copula, auxiliary, modal, inflection}, goes along with the systematic presence of a subject/topic. The subject obligation for predicates is known in generative grammar as standard EPP. D-marking, i.e. the marking of a noun by a {determiner, possessive, demonstrative}, is accompanied by the appearance of the personal pronoun system (*he/him*). Predicate marking and reference marking are overwhelmingly present in the input data, but that does not answer the question how the learning procedure succeeds to identify them and why it selects them for early acquisition.

The observational data for Dutch and French below demonstrate that I-marking precedes D-marking and that the φ-marking on the subject D^o precedes AGR, the φ-marking on I^o. We postulate that the reconstruction of specifically D-marked arguments as <+reflexivization> or <+wh-questioned> follow later. They lack D-features and require a D^o-antecedent in an IP or CP specifier position.

4.1 Order of acquisition steps: I-marking precedes D-marking

Blocking in language acquisition can be traced by longitudinal graphs (Van Kampen, 1997). These reflect the quantitative relation between a less specified (unmarked) variant and a more specified (marked) variant. The latter will eventually block the former. The graphs start when *the more specified variant* is less than 10% and they end when *the less specified variant* is less than 10%. See the graphs for Dutch I- and D-marking (figure 1) and for French I- and D-marking (figure 2).
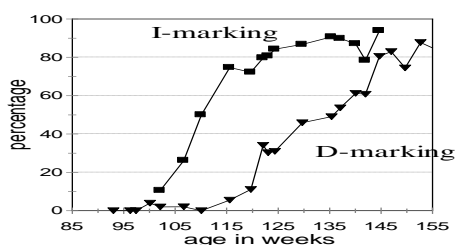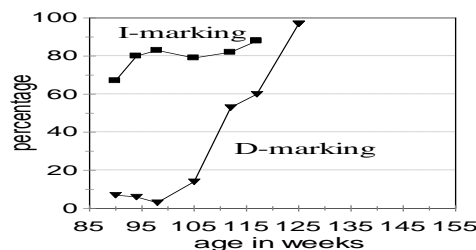

Figure 1: Dutch Sarah   Figure 2: French Grégoire

The amount of determiners (articles/ demonstratives) outweighs the amount of copulas/auxiliaries in the input data. Yet, the less frequent I-marking precedes the more frequent D-marking in acquisition. This is explained by point (2)c above. Initially, sentences with both a D-marked noun and an I-marked verb are thrown out of the observation space. D-marking, although more frequent, will not often occur without an I-marking {*the bear must eat*}, whereas I-marking may and will often occur without a D-marking {*bear must eat*}. If so, "I-marking precedes D-marking" is potentially a matter of universal acquisition order.

The systematic I- and D-marking themselves give entrance to a whole series of further acquisition steps, beginning with a grammatical decision procedure on the category membership N versus V.

4.2   Acquisition steps due to local evidence frame IP/DP

All the primary steps are a feature spelled out in a context of adjacent sisters.

<u>Step 1</u>   *I-marking and the category <+/− V>*
The systematic marking of "comment" parts is realized by a variety of devices {copula, modal, auxiliary, inflection} The distinction between the lexical heads in the predicate follows from their association with different I°-markings as in (3).

(3) $X^o \rightarrow <+V> / I^o modal$ — $X^o \rightarrow <-V> / I^o copula$
                    $X^o \rightarrow \quad <+V> / I^o_{<inflection>}$

There are no mistakes in the selection of I° and <+/−V°> items. This shows that acquisition by repetitive context is an effective construction device. The short sentence forms used by children will enhance this effect (cf. Elbers 2002).

<u>Step 2</u>   *EPP (subject-requirement)*
Utterances consisting of no more than a comment are quite possible, but the I°-marked comments will rarely miss a topic. We intend to develop this into an argument that I°-marking is acquired as marking the context of a topic.

(4) $\varnothing \quad \rightarrow I^o$ / topic [— [comment]]

The acquisition of the I-marking is probably part and parcel of the acquisition of the EPP (subject-requirement). The standard EPP is the first step and the basic step in acquisition. The EPP is the acquisition step that must guarantee that each predicate is "anchored" due to the obligatory presence of a subject. It should be possible to demonstrate this quantitatively for any language.

<u>Step 3</u>   *D-marking and the category <+N>*
The naming topics that are not proper names are either a demonstrative or a D-marked noun. The D-marking of the topic by articles and attributive pronouns can be captured in an acquisition graph (see figure 3 below).

(5) $\varnothing \quad \rightarrow D^o$ / [— [X]$_{topic}$]

It stands to reason that the systematic association of certain lexical content words with D-marking, leads to the category N, see (6).

(6) $X^o \rightarrow <+N> / D^o$ —

The context of a sister D° would not hold in the adult language, but within the simplified context of child language, there is sufficient evidence to figure out the category <+N>. By itself, the <+N> is not referential, but in a highly repetitive context D°, it fits the same topic position as proper names and independent demonstratives. The acquisition rule may have the form in (7).

(7) $\varnothing \quad \rightarrow D^o$ / [— [X]$_{referential}$]

<u>Step 4</u>   *Free anaphors (clitics and pronouns)*
D-marking is not the marking of a somewhat hidden category <+N>. In the same vein, I-marking is not the marking of a somewhat hidden category <+V>. I-marking and D-marking are rather the grammatical expression for the predicative (characterizing) and the referential (naming) function of lexical content elements. The strange thing is that many positions where the X<+N> appears {*read booklet*, *drives car*, *sees house*} get the D-marking inserted. Personal pronouns (Dutch *hij/zij/haar/hem*; French *il/elle/lui*; English *he/she/it/him/her*) appear in the same frames at the same moment. The use of personal pronouns in the files of Dutch Sarah rises to input level simultaneously with the insertion of D° elements next to the

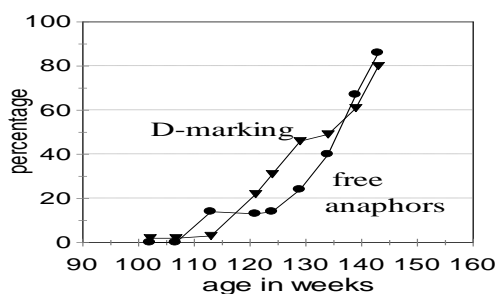[X<+N>]. See figure 3. They underline Postal's (1966) view that pronouns and articles are both Dᵒ.

Figure 3: Dutch Sarah

This suggests strongly that the real acquisition step has been "mark naming elements by Dᵒ". The naming parts are explicitly getting the referential function: Find out what is named by looking at the syntactic structure. Whereas naming and commenting are merely pragmatic (situation-bound) intentions, reference and predication are tied up with explicit grammatical marking. They cannot do without syntax. The arguments establish the UTAH (Baker, 1985), i.e. the assignment of theta-roles to fixed positions. The UTAH offers an evidence frame for the subsequent acquisition of clitic arguments in French (Jakubowicz et al., 1998). What we have in mind here is that D-marking is part of the acquisition of UTAH, like I-marking is part of the EPP (Van Kampen, 2003). They stand for the acquisition of predicate structure (I-marking) and argument structure (D-marking).

4.3   Local evidence frames outweigh mere input frequency

A general property of 'decoding' emerges as well. The successive evidence frames narrow down to a far more precise context and the speed of acquisition increases by an order of magnitude.

The subject/topic of the previous steps still lacks φ-features of person/number (i.e. it is 3rd person singular only: Benveniste, 1966). D-marking establishes the EPP as relation between a head and its specifier. That opens the way to figure out in a subsequent step the φ-feature content in Dᵒ, {± person, ± number} on the subject, i.e. oppositions between 1st/2nd/3rd person and singular/plural subjects.

(8)   des motos (plural) fait (singular) du bruit   (motors make noise; Grégoire 2;01.25, week @@)

The finite verb still doesn't show the correct agreement with the subject. One step later, the initial I-marked predicate constitutes the local evidence frame for Agreement features, the copying of the φ-features on the Iᵒ. The finite verb starts showing the correct agreement.

(9)   elles sont aux Etats-Unis, mes sandals   (they are in the USA; Grégoire 2;05.23, week @@)

Now, both Sarah and Grégoire acquire φ-oppositions on the subject before the finite verb starts showing correct agreement. The succession of the acquisition steps also shows the same relative speed. The later steps are a matter of weeks whereas the earlier steps were a matter of months, see (10) for Dutch Sarah.

(10)   *EPP as evidence frame*

step Iᵒ	step Dᵒ	step Dᵒ (φ)	step Iᵒ (φ)
20 weeks	25 weeks	5 weeks	5 weeks

The more effective acquisition relates plausibly to the more precise frame that can be used to select the input. The selection of some binary combination of content signs is far more undetermined than the distributional relation between explicit grammatical markings such as φ-features and Agreement. The later set of acquisitions is supported by a lexicon with categorial marking <+I> or <+D>. We propose that

after step 1 and step 2, the EPP operates as an evidence frame. The input has not been lacking in φ-features on I and D, rather the φ-features could not become part of the intake before I and D had been established. It is only after the acquisition of I-marking and D-marking that the EPP begins to function as an evidence frame, a preceding structure that is needed to spot the relevant points. It appears that *evidence frames outweigh mere input frequency*.

5   Conclusion/perspective

To summarize, the I-marking precedes the D-marking and both take place within binary structures. Both create a new local frame that will serve to introduce the lexical categories V and N. The initial grammar with I/D/N/ and V offers more detailed frames for the acquisition of subject agreement and dummy subjects both related to the EPP predicate structure, and more detailed frames for the acquisition of reflexivization and clitic structures related to UTAH/argument structure (see also Van Kampen, 2003). It is clear that the observation space of the acquisition procedure is not a constant factor. It is enlarged with each acquisition step (Van Kampen, 1997). It will have to be enlarged in order to explain the variation in argument structure that appears in clitic movements, reflexivization, V-to-I and I-to-C movement. Locality in grammar will eventually be derived from learnability. In short, UG will be derived from elementary properties of the Acquisition Procedure.

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