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An alternative scenario for the acquisition of syntactic categories

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In LINK 11.4 Bas Evers discusses two theories for bootstrapping lexical categories (N/V/A/P) in language acquisition. This note advances an alternative.[1]

Summary

The bootstrapping metaphor was introduced by Pinker (1984). Pinker's procedure for language acquisition derives the universal syntactic categories N and V from an innate cognitive orientation that divides the world in things and actions. Pinker's paradox is that the primary syntactic categories (N/V) follow from a procedure that is syntax-free. That is his 'bootstrap'. The less universal part of grammar may subsequently be perceived and learned from configurations of N and V. My thesis (Van Kampen 1997: chapt.2) suggested an alternative to Pinker's scenario. The learner would start with category-neutral content words. Binary configurations of neutral words fit an innate grammatical orientation in subject-predicate structures. The first grammatical categories are the language specific marking for 'subject-reference' (D) and 'predication' (I). The categories N and V are learned much later as those category-neutral content words that have a syntagmatic relation with D (reference) or I (predicate). My paradox is that universal syntactic categories N and V emerge later on by means of language specific cue's for D and I/(C). There are no bootstraps in the sense of Pinker.

Pinker's scenario

Pinker's (1984) semantic bootstrapping mechanism derives lexical categories from general cognitive notions, like 'thing' (N) or 'action' (V). An innate set of procedures would subsequently map the primary syntactic categories (N and V) onto the phrase structure (S →NP VP). The child's early word

combinations are in Pinker's theory assumed to project the full category labels NP and VP. I suppose that, within such a view, the lexical/conceptual structures (NP/VP) will in turn constitute a platform for learning the functional projections (DP/IP/CP). In short, the acquisition procedure would translate a cognitive system (thing/action) into a system of lexical categories (N/V) and these would open the way for functional categories (D/I). The translation from the cognitive orientation towards the grammatical point of view was called 'bootstrapping'. Pinker revised his semantic bootstrapping theory thoroughly in Pinker (1987,1989). Nevertheless, he continued to defend the position that lexical categories are accessible to the learner in a syntax-free manner.

Gleitman (1990) used the same metaphor 'bootstrapping' as well, but in a different way. She argued that a grammatical frame would strongly support the development of a cognitive frame, which suggests a reverse of the view proposed in Pinker (1984). For instance, the meaning of a verb is 'syntactically bootstrapped' through the learners attention to the argument structure. According to Pinker (1994) the term 'bootstrapping' is misguiding in that context, because Gleitman applies bootstrapping to the acquisition of the lexicon after the differentiation of a general category X into N/V/A/P, i.e. after the emergence of the parts of speech system. Pinker prefers to reserve the term 'bootstrapping' for a learning procedure that switches from one component to another, whereas it was Gleitman's intention to consider vocabulary acquisition only.[2] Gleitman might have been intrigued by the explosive expansion of vocabulary once primary syntactic structures have been established.[3]

Both Gleitman's and Pinker's points of view deserve our attention. On the one hand, a configurational learning strategy seems to be necessary anyway. Consider for instance the following. It is not possible to determine the <+/-N> and <+/-V> status of items like *sleep, breath, brake, shower, play, walk, laugh, stay* etc., if there is no context like, for example, *a sleep* or *I sleep*. This holds for the adult language in these specific cases as well as for child language in general. The category status of e.g. *sleep* is determined by its syntactic context. Categories that are bound to be in one of these contexts are N or V: **I tree / a tree: tree* <+N> and *I think / *a think: think* <+V>. On the other hand, and this is Pinker's point, syntax considered as a word-learning device does not answer the crucial question at which point of acquisition and by which strategy the learner gets access to the parts of speech <+/-N>/<+/-V>.

I may further observe that most studies of child language have little qualms in ad hoc applications of the standard X-bar categories. The learnability of syntactic categories is nevertheless a serious issue, be it a neglected one. Present day grammatical theory tends to enrich the category system in order to reduce syntax to 'bare conceptual necessity' (Categorial Grammar, and now also Chomsky 1995). Therefore, the learnability of categories has become a major issue.

An alternative scenario

I simply follow chapter 2 of my thesis. Some quite general grammatical-semantic functions are to be considered as innate in any bootstrapping category. Suppose then that the learner has minimally the following grammatical-semantic functions at his disposition: deictic reference, theta-relations, predication relations, illocution (wish, question, statement, refusal, exclamation). These functions reflect elementary semantic relations at LF (see Van Kampen 1997 for an elaboration). In child language these semantic relations appear in the two-word utterances in (1).

(1) a. *deictic reference*

dat beer	(that (is) teddy-bear)

b. *predication*

beertje slapen	(teddy-bear (must) sleep)
deur open	((the) door (is) open)
pappa lief	(daddy (is) nice)
boot daar	((the) boat (is) there)

c. *theta-relations*

boekje lezen	((I want to) read (a) booklet)
banaan eten	((I am going to) eat (a) banana)
met fiets	(with (the) bicycle)

d. *illocution*

beertje nou? (question)	((where is) teddy-bear then?)
ikke/ook beer (wish)	(I (want) teddy-bear)
beertje daar (order)	(teddy-bear (must go) there)
beertje lief (statement)	(teddy-bear (is) nice)

The interpretation of the structures in (1) by means of the category labels N/V/A/P, though, could betray an over-interpretation by the adult listener. It will be argued below that the learning procedure starts with a spell-out of the general semantic functions by means of functional markings for D, I and C. Once these functions have reached their language specific form in functional categories there is a syntactic platform for labeling the lexical categories as N and V. The scenario will be given for the two more 'basic' lexical categories, i.e. the category N (section 2.1) and the category V (section 2.2).

Bootstrapping N

Semantic bootstrapping theories for the category N (e.g. Fisher et al. 1994) observe that one-word (single sign) utterances seem to name and characterize identifiable objects in the situation.[4] Therefore, the child who applies semantic bootstrapping could already assign these words to the category N. However, a more cautious description is possible as well, if one considers the following. The categories < +N > and < +V > belong to a *syntactic* system. A single sign X, syntax free and therefore category neutral, can be used, and is used by the child, as a name $X_{<+ref>}$, as in (2)a, or as a characterization $X_{<+pred>}$, as in (2)b. This depends on the pragmatic intentions of the speaker, not on any property inherent to the sign.

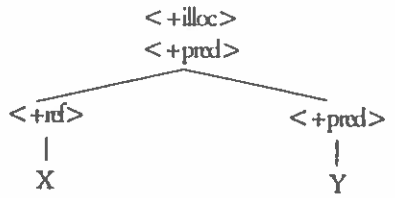
(2) a. beertje (proper name with fixed reference, i.e. name for the child's cuddly bear)
b. beertje (characterization of a set of animals)

The two-word utterances in (3), by contrast, present a characterization of the situation.

(3) a. beertje slapen (teddy-bear sleep (is sleeping))
b. beertje daar (teddy-bear (must go) there)

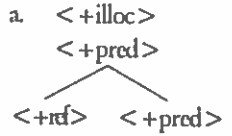
The first sign seems to be intended as < +ref > (name), and the second sign as < +pred > (characterization). Since the combination of the two is again an overarching characterization, a category-neutral approach may assume the structure in (4) for the utterances in (3).

(4)



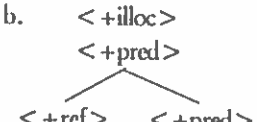
Consider now the following examples of two-word utterances without category labels, cf. (1)a,b.

(5) a.



beertje	*slapen*	(bear sleep)
pappa	*lief*	(daddy nice)
deur	*open*	(door open)
boot	*daar*	(boat there)

b.

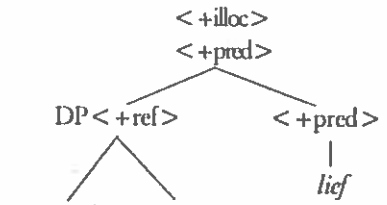


dat	*beertje*	(that bear)
dat	*pappa*	(that dad)
dat	*deur*	(that door)
dit	*boot*	(this boat)

These category-neutral utterances show several peculiarities. Firstly, all signs are characterizing and can be used as < +pred >, except the sign *dat/dit* ('that'/'this') for the pointing gesture $D_{<+ref>}$. This sign clearly has a different category since it cannot be used as < +pred >. It is inherently < +ref >. There is a second peculiarity. The predicates assigned to D in (5)b (*beertje/pappa/deur/boot*) are used in the first position of (5)a, whereas one would not expect all < +pred > signs to be able to do that. The signs Y in (5)a (*slapen/lief/open/daar*) are atypical in the position of D in (5)b.

The learner might now assign the category N to the D-predicates. This of course would be a kind of syntactic bootstrapping. There is attention to substitution properties in a syntactic frame. One can also assume, though, that categorization is somewhat more delayed, until the categories are suggested by syntagmatic properties. Suppose the learner gets the problem of a three-word predication.

(6)



(that bear (is) nice)

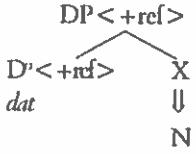
The pragmatic intention of using X as <+ref> in (5)a is now expressed syntactically by means of the non-characterizing functional category D. This opens the possibility of a two-step bootstrapping procedure in (7) and (8).

(7) <+ref> ⇒ D (Bootstrapping: from pragmatic intention to syntax)

(8) $X_{<lex>}$ ⇒ N / D— (No bootstrapping: syntax intern)

The first step in (7) identifies the category D as a sign of <+ref>. The second step in (8) identifies a sense-bearing word X as having that reference. The significance of the lexical category N would be: "is bound to build structure with D". This will bring the learner to (9).

(9)



One might wonder what the advantage is of the procedure sketched above. Pinker's procedure bootstrapped by cognitive semantics <+thing> ⇒N. The present procedure is more roundabout. It 'semantically' bootstraps <+ref> ⇒D by (7) and subsequently it syntactically bootstraps X ⇒N by (8). Moreover, there are obvious problems with the naive context condition in (9).[5] There are, however, two global advantages to the idea that the learner 'backtracks' lexical categories from their grammatical configuration. Considering these advantages, it is worthwhile to work out the problems.

The first global advantage becomes clear if we look at the characterization of functional categories by Emonds (1985: 191).

a. They are grammatical constants, i.e. they are closed class elements that contain a small set of words which cannot be added on to.
b. They differ only by syntactic features and cannot be differentiated from each other by lexical semantic features.

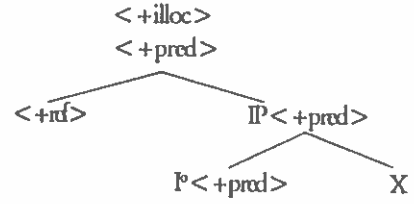
Evidently, functional categories are highly frequent. They are structurally identifiable without reliance on the content of the sense-bearing items, and they are reaffirmed all the time. These are the very properties one would like for 'bootstraps'. Sense-bearing items (lexical categories), by contrast, have a lower text-frequency, a less outspoken distribution and their semantic properties are notoriously elusive.

Moreover, and this is the second global advantage, *no* division of the sense-bearing items into <+thing>-name ⇒N versus <+action>-name ⇒V could itself give rise to the notions 'subject reference' (D), 'predication' (I) or 'illocution' (C). The subject/predicate frame is an innate point of orientation for Pinker as well. Syntactic bootstrapping in two-word utterances can be supported by substantive syntactic universals like subject first (the aboutness sign first) and stress on the predicate (the new information second). In general syntactic bootstrapping is forced to ask which elementary structures are needed to pin down the language-specific properties of D, I and C. If something of these categories is known, the syntactic categorization of sense-bearing items will follow fairly easily.

Bootstrapping V

The bootstrapping of X = V must proceed in a similar way, see (10) and (11). If a sense-bearing element carries a predicational index, it should be accompanied by function-bearing constants I°.

(10)

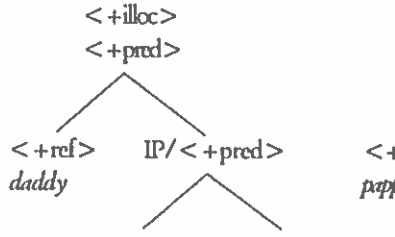


(11) a. <+pred> ⇒ I (Bootstrapping: from pragmatic intention to syntax)

b. $X_{<lex>}$ ⇒ V / I— (No bootstrapping: syntax intern)

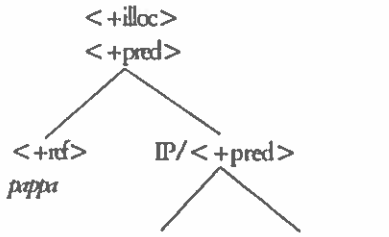
If one looks at frame (10), though, the following objection may arise. In the adult target language the I-constants are the copula, the modal, the auxiliary and the finiteness on the verb. Characterization by a non-copula auxiliary or by <+fin> morphology may separate the V-class from other lexical classes. However, one of the members in I° is the copula *is*. The immediate application of (11) will now have the undesirable effect that all predicate heads are turned into V for Dutch as well as for English, see (12).

(12) a. English



a. *bear* (N)
b. *nice* (A)
c. *up* (P)
d. *walk-ing* (V)

b. Dutch



a. *beer* (N)
b. *lief* (A)
c. *op* (P)
d. *lopen* (V)

The abstract structural condition therefore needs to be diversified. Say for English as in (13).

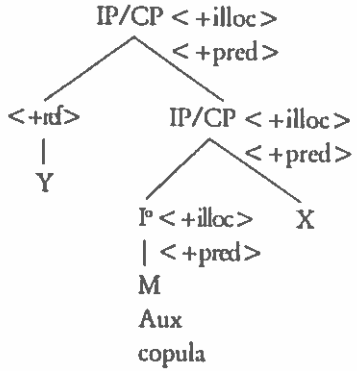
(13) $X_{<h>} \Rightarrow$ V / M(odal) —
has [— <+past participle>]
is [— <+ing>]

The acquisition picture for V-second Dutch is different, but the problem for the rule (11)b remains the same. Rule (11)b can be applied for (12)d.[6] However, (12)a,b,c seem to make it necessary again to refrain from the abstract functional category <I> in order to refer to specific representations of I°. In Dutch the I-constants,M(odal), Aux or the copula, mark the

<+pred>

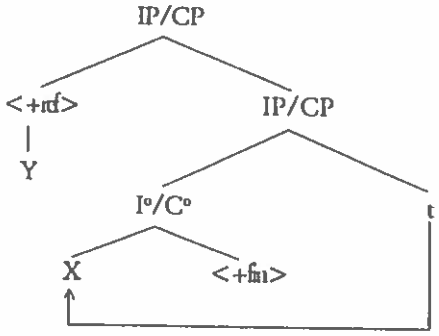
predicate as well as the illocution, see (14).

(14)



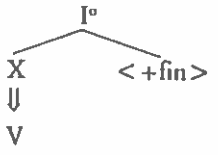
The position I°, though, is not necessarily filled with a functional word. If no functional element is filled in, some of the sense-bearing X's may move in and get the morphological marking <+fin>.

(15)



This context (15) now is unambiguous for X⇒V.

(16)



The V-second rule and the <+fin> category are acquired early and speedy (< 15 weeks). Yet, there are several problems. I will not get into them here, but see Van Kampen (1997: chapt.3) for an attempt to get a category-neutral

acquisition procedure for the V-second rule.

There is a more general question to consider. Let us make, for the sake of argument, the following assumptions.

a. any language offers an array of variants for the phrase $[I\ XP]_{IP}$
b. a few of these variants offer an unambiguous context for a rule $X \Rightarrow V$.
c. there is a clear moment in the learning procedure when the unambiguous context has been acquired.

How is the learner informed that the triggering context for the category V has been acquired? How does the learner know that the appropriate, but language specific variants of (11)b must become active? For someone who still holds on to the perspective of semantic bootstrapping, these are damaging questions. According to that view (semantic bootstrapping towards lexical categories) the acquisition of grammar could make little headway unless the sense-bearing lexical categories are categorized as N and V. Moreover, it stands to reason that the learner cannot be informed about the language he is in.

The picture changes if one takes the perspective of syntactic bootstrapping towards lexical categories. Asking now which sense-bearing lexical items are N or V is a different matter. Grammar resides primarily in the highly frequent functional categories (the D, I and C types) and only derivatively in the categories of the sense-bearing lexical items. Once the grammatical frames have been set up by means of functional markings, the learner may become accustomed to the further distributional constraints that are imposed on the sense-bearing items by the grammatical frames.

Conclusion

I see no compelling argument for Pinker's claim that the learning procedure is in need of, or even supported by, immediate access to the parts of speech <+/-N>/<+/-V>. I would rather say that the learning procedure needs a kind of innate expectation of D, I and C categories and that these devices will open up the lexicon. Paradoxically speaking, it seems now that Gleitman was more right than Pinker. There might be an syntactic bootstrapping switch from grammar to grammaticalized lexicon.

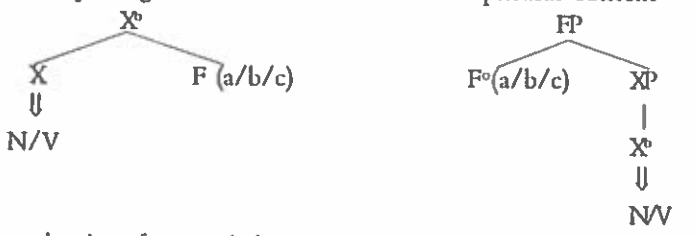
The present note sketched an syntactic strategy for the bootstrapping of

syntactic category labels. The grammatical semantic functions <+ref>, <+pred> and <+illoc> have the potential of becoming a functional category, i.e. D° or I°/C°. They are bootstraps for the (highly frequent) set of constants. The differentiation between <+N> and <+V> cannot take place before <+ref> and <+pred> are expressed by functional categories. See the bootstrapping procedure in (17).

(17) *Bootstrapping procedure*

a. <+ref> ⇒ D
b. <+pred> ⇒ I
c. <+illoc> ⇒ C

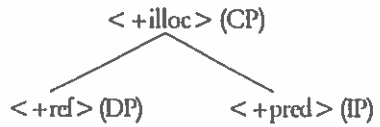
morphological context *or* phrasal context



A good point of syntactic bootstrapping is that no reference is made to content notions like 'thing' and 'action', but only to pragmatic intentions that are reflected in functional categories. For that reason, syntactic bootstrapping predicts that action nouns and stative verbs are possible in child language without any trouble. This seems to be according to the facts. Semantic bootstrapping towards lexical categories, by contrast, begins with excluding the existence of action nouns and stative verbs as a matter of principle. Since such items will nevertheless appear quite soon in the language of the child, semantic bootstrapping is bound to get a full rearrangement of its procedures. A similar problem arises for the acquisition of active and passive predicates (see Pinker 1989: 413; Gropen et al 1991). Subject-predicate relations vary from an inherent actor/action relation to theme/change-of-state relations. If the subject-predicate relation is at first identified as an actor/action relation, instead of the other way around, it must be that the appearance of theme/change-of-state predications imply a reversal of the strategy. And yet, passive variants appear as early as predicate I-marking and even without past participle marking (Verrips 1996).

Two remarks may be added. In the first place, the present procedure postulates the a priori triple in (18).

(18)



The a priori triple in (18) is not meant to introduce multiple D (definiteness/number), multiple I (modal/tense/aspect) and multiple C (topic/focus) as a set of innate content universals. Rather, it is hoped that such hierarchies will be learnable as options of arbitrary language-specific design.

In the second place, the syntactic bootstrapping is as yet not a solution of any specific acquisition problem. It is a proposal to approach acquisition problems in a certain way. At the moment we cannot predict the order or the relative speed of the various acquisition steps, nor how these steps can be constructed from simple structures. It is all unknown, but it may be figured out by studying syntactic bootstrapping.

Postscript

I presented this alternative to Pinker in my thesis. I was quite happy to have found a syntax-internal procedure for labeling lexical categories. Last year, though, in classes given by Makoto Kanazawa, it became clear to me that Buszkowski had already seen the same logic ten years earlier and presented it in a formally rigorous way. He had defined an algorithm for finding a categorial grammar from data that consist of functor-argument structures (Buszkowski 1987; Buszkowski and Penn 1990). Functor-argument structures are like phrase-structures without lexical category labels. The Buszkowski algorithm assigns variables to arguments (roughly: lexical categories). Subsequently, the arguments are labeled on the base of their configuration with a functor. In his thesis, Kanazawa (1994) formally proved the learnability of classes based on variations of the original Buszkowski's algorithm.

The mere presence of a formal modal of learning does not of course imply that it will be applicable to the real life procedures of first language acquisition. The final question therefore is: which specific acquisition facts strongly favors one of the two scenario's?

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Verrips, M. (1996) *Potatoes must peel: the Acquisition of the Dutch Passive*

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