

Van der Hulst starts by extracting five key aspects of recursion from the HCF (2002) paper and turn them into a five-point list. What points (a) through to (e) all have in common is the assumption that recursion is somewhat **uniquely human**. As HCF state, it could indeed be the case that recursion evolved in other species and for other purposes as well – only later would it be used to yield linguistic unbounded infinity (see also “Further Matters”). In fact, I believe that it is here where the real interface to ongoing research lies.

Just very briefly another note on the relation of recursion to the FLN: If one follows minimalist argumentations, then one would like FLN to be as slim as possible, possibly identifiable by one key component. HCF say that recursion is “a core property of FLN, attributed to narrow syntax” (HCF 2002: 1571, my emphasis). This engenders the (Q-Scalar) implicature that there **may be more core properties of FLN**. In the same paragraph, HCF say:

“[...] a key component of FLN is a computational system (narrow syntax) that generates internal representations and maps them into the sensory-motor interface by the phonological system and into the conceptual-intentional interface by the formal semantic system” (HCF 2002: 1571, my emphasis).

Just for clarification of this one, I believe one would have to say something like: *The narrow syntactic computational system works recursively*. This suggests that **recursion is a method** by which narrow syntax engenders a discrete infinity of internal representations. Thus narrow syntax ≠ (read: is not) recursion, but narrow syntax = (read: is) recursive.

But what is (the nominal) recursion and what are recursive functions? The operation Merge in itself only yields what van der Hulst calls, rightly, I presume, **general recursion**:

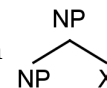
1.  $K = \{\gamma, \{\alpha \beta\}\}$ , where  $\alpha, \beta$  are syntactic objects taken from the Numeration  $\{\alpha, \beta\}$  and  $\gamma$  is the label of K.

Now, the Numeration can vary in length, but what is essential is that Merge only applies **once per step** and only merges **one element at a time**. Merge is successively adding elements to K. Note also that it is generally assumed that **one element of the Numeration actually labels K**. This means  $\gamma = \alpha$  if  $\alpha$  is the labelling element – let's for the moment think of labelling as syntactic projection. If we look at all this we may conclude that any concatenation (Merge) is recursive. And in general recursion this seems indeed to be the case.

What we normally assume to be recursion is in fact a case of **special recursion** (see p. xxii), a **sub-type of general recursion**.

2.  $NP \rightarrow NP + X$ .

Read: “Rewrite NP as NP and X”. Or: “An NP can consist of an NP and an X”.



A good point made by Pullum and Scholz is that potential discrete infinity can be achieved solely by applying **iterative functions**. Thus recursion would be rendered redundant. As far as I can see, iteration means “take the output and make it the input – repeat desired times”. Sorry that neither Wikipedia nor Pullum and Scholz provide a down-to earth example, so here is my shot at it.

x	→	ab	(step 1)
ab	→	y	(step 2)
y	→	z	(step 3)
:			
:			
:			

From Tomalin (2007) I glean that in iteration, “rules are simply applied one after another in

sequential order” (Tomalin 2007: 1791). Would this implicate that recursion is non-sequential? What about general recursion (via pure Merge)? You surely take the output of one Merger as input to the next – only one at a time.

Anyway, besides these really foundational issues here is where it gets syntactically concrete:

3. Nested recursion:        [a<sub>1</sub> [b<sub>1</sub> [c<sub>1</sub> c<sub>2</sub>] b<sub>2</sub>] a<sub>2</sub>]  
 Tail recursion:            [ [ [ [ [NP<sub>1</sub>] NP<sub>2</sub>] NP<sub>3</sub>] NP<sub>4</sub>] S<sub>=passive here</sub>] / [S<sub>1=matrix</sub> [S<sub>2</sub> [ S<sub>3</sub> ] ] ] ] ]

### A Comment on Nested Constructions

On page xxiv we find a hardly parsable yet grammatical construction:

4. [The man [the boy [the girl kissed] hit] filed a complaint.]

I highlighted the syntactically discontinuous elements. Just for the sake of it, here the construction in German:

5. [Der Mann, [den der Junge, [den das Mädchen küsste,] schlug,] reichte eine Beschwerde ein.]

I would say better parsable or only very slightly? Note the case marking in the articles. Now let's look at a different construction involving different  $\Theta$ -roles:

6. [Der Mann, [der das Mädchen, [das gerade mit dem Jungen sprach,] unterbrach,] war unhöflich.]

Could you recognize any change of acceptability? Unfortunately, it is difficult to find an English corresponding example. It would lead to a multiple relative clause construction. Something like this:

7. [The man [who interrupted the girl [who was talking to the boy] ] was impolite.]

In (7) we have only one discontinuous element. Here is another discontinuous element squeezed into the nested construction:

8. [The man [who was looking the old saying [that nobody knew] up] was a philologist.]

This apparently verges on the brink of unacceptability (possibly due to “heaviness effects”). Just let's come back to example (4) and insert some *wh*- elements:

9. [The man [whom the boy [whom the girl kissed] hit] filed a complaint.]

Does this sound more acceptable? If it does so then why? Probably, performance-related reconstruction is facilitated by inclusion of the relevant pronoun and **overt case marking of nested elements**. Let us contrast this directly.

- a. [The man [the boy [the girl kissed] hit] filed a complaint.]  
 b. [The man [whom the boy [whom the girl kissed] hit] filed a complaint.]  
 c. [Der Mann, [den der Junge, [den das Mädchen küsste,] schlug,] reichte eine Beschwerde ein.]

- d. [Der Mann, [der das Mädchen, [das gerade mit dem Jungen sprach], unterbrach], war unhöflich.]

In German, case marking and general presence of the *wh*- elements are obligatory. If (b) and (c) are better parsable, then why is this so? In English we cannot mimic (d) (see (7)), but what, in this case, makes the German example relatively easy to parse is its **Θ-structure**. As far as I understood van der Hulst, he does not consider this explanation. No literature either is given – is there any? What do I mean?

Non-nested (a) has this very rough Θ-structure:

[girl<sub>kiss</sub> (=Agent) boy (=Patient)] >>> [boy<sub>hit</sub> (=Agent) man (=Patient)] >>> [man<sub>file</sub> (=Agent) complaint (=Patient, Theme)]

This would roughly correspond to *The girl kissed the boy who hit the man who filed a complaint*. This is not a nested construction. The nested construction looks like the following.

[*The man<sub>j</sub> [the boy<sub>i</sub> [the girl kissed ~~the boy<sub>i</sub>~~]<sub>who</sub> hit ~~the man<sub>j</sub>~~]<sub>who</sub> filed a complaint.*]

Stripped down to Θ-minimum:

[man<sub>j</sub><sub>file</sub> (=Agent) [boy<sub>i</sub><sub>hit</sub> (=Agent) [girl<sub>kiss</sub> (=Agent) boy<sub>i</sub><sub>(=Patient)</sub>] man<sub>j</sub><sub>(=Patient)</sub>] complaint (= Patient, Theme)]

I would like to call this **Patient-to-Agent-Promotion (PAP)** – now I've also coined a nice acronym. One could analyse this via UTAH and show explicitly the movements through the different Θ-positions.<sup>1</sup> The important thing is that this has **apparently a direct reflex on parsability**. In processing the given construction one has to “**play it backwards**” if you will. When perceiving *the man* and *the boy* at the beginning of the string, we rightly interpret them as Agents and only later do we realize that **reinterpretation as Patient** is required. This is a computationally loaded process. Certainly some interesting psycholinguistic question.

Now if we have case-marking this might facilitate processing, as is supposedly the case in (b) and (c). Note that this predicts that if the string starts with Agents all along no PAP is required. I wanted to show this in (d). As far as I understand, **PAP of *Der Mann* is not required so Agenthood reconstruction is not necessary**. Only *das Mädchen* has to raise from Agent (*das Mädchen sprach gerade mit dem Jungen*) to Patient (*der Mann unterbrach das Mädchen*). In German this seems to be the case with the difference between English and German being that in the former we do not have this in discontinuous (i.e. nested) constructions – speculatively for morphological (i.e. case-marking reasons).

### Carr (1990)

On with van der Hulst. On p. xxxi he mentions a source without providing full reference. It's in this references section. Very briefly:

1 **One big thing is:** Normally, one would not assume movements to go through different theta positions. A syntactic element starts out as, say, Patient and would remain Patient. **Another thing is:** What function would one attribute to the relative pronoun? And one final point: If you put (d) into the passive (*Der Mann, der vom Mädchen, das gerade mit dem Jungen sprach, unterbrochen wurde, war empört.*) then this construction is not more difficult to parse than original (d). According to PAP, the opposite would be the case. One would have to look for somewhat syntactic “minimal pairs” - not easy, since expression in English would differ.

*The Realist*

- Devise from **observable phenomena** or **sense data theoretical constructs** descriptive of **“hidden” reality “behind” sense impressions**. (inspired by Popper)
- “If we allow that generalizations about a domain of inquiry can be expressed by showing that a range of phenomena follow from (stronger still, are caused by) some (law-like, or other) property of the underlying reality, then we can claim to have achieved an explanation of those phenomena” (Carr 1990: 2).

*The Instrumentalist*

- “Propositions expressed as sentences which contain theoretical terms are neither true nor false, since our theoretical terms are not observational terms but are **tools, and nothing more than tools, for the ordering and predicting of observations**” (Carr 1990: 2).

In what follows, van der Hulst introduces – by having read the abstracts (!) to the edition's contribution – the different stances taken in the volume.

**Hornstein (2009)**

Just a word on Hornstein (2009) and van der Hulst's interpretation.

“According to Hornstein (2009: 59-60) it is the emergence of this specific labelling convention (i.e. projection from the head) which kick started recursion in the evolution of language” (p. xli).

In Hornstein, we find a two-step process. The pre-linguistic notion of **concatenation**. This operation is **recursively applicable**. From  $A^{\wedge}B$  (read: A concatenated with B) we can create an infinitely long string ( $A^{\wedge}B^{\wedge}D^{\wedge}C^{\wedge}E \dots$ ). Note since concatenation can apply repeatedly, all this “algorithm” is **already recursive in itself**. So we do have genuine recursion pre-linguistically. I would very much like to think this type of recursion corresponds to van der Hulst's **general recursion** in the sense of a pure Merge operation. The specifically linguistic innovation is labelling. Hornstein writes:

“It is the source of (unbounded) nesting for it functions to turn a non-atomic concatenate into an atom liable for further concatenation.

[...] Labelling as construed here carries (nested) recursion on its sleeve [...]. To be tendentious, endocentric labelling is the evolutionary innovation which when combined with concatenation yields the unbounded nested structures characteristic of natural language sentences” (Hornstein 2009: 60).

Labelling brings order to concatenates:  $[_B A^{\wedge} [_B B^{\wedge} [_E D^{\wedge} [_E C^{\wedge} E]$ , being irrelevant here what labels what. But **recursion as such is already available to the concatenation process**; it is not created by the labelling operation as is seemingly thought by van der Hulst. What we have boils down to this: **concatenation** (Merge) > **labelling** (sets, sub-sets, “projection”). According to van der Hulst's diction, nested constructions belong to **specific recursion** – and it is exactly this specific recursion that is engendered by the innovative linguistic process of labelling.

**General Remarks**

I will skip the introduction of the contributors' various stances here and come to a general remark on recursion.

Once upon a time recursion was a **formal modelling device**, borrowed from the formal sciences and applied to linguistic problems. An inspiring influence came from Yehoshua Bar-Hillel. In a paper of the year 1955 Chomsky mentions his name about 23 times and assesses his contribution to the solution of certain linguistic problems. However, in more recent times

some conceptual shift in understanding the notion of recursion can be perceived. **It has become more than a useful constructional procedure. Its status has constantly been elevated to a key feature of the human language faculty.** The alleged failure of classical evolutionary models to explain the arithmetical capacity of humans has inspired Chomsky to reconsider recursion's status – out came, as a case in point, HCF (2002). Tomalin writes:

“As a result of this perceived connection between the linguistic and arithmetical capacities, Chomsky has recently suggested that, rather than merely constituting a useful constructional procedure that was initially derived from the formal sciences, recursion may actually constitute a unique language-related aspect of human cognitive function” (Tomalin 2007: 1795).

### Further Matters

Just as van der Hulst (2010) frequently refers to this text, here is a more or less impressionistic synopsis of HCF.

Hauser, Marc D. Noam Chomsky & Tecumseh W. Fitch. 2002. The Faculty of Language: What Is It, Who Has It, and How Did It Evolve? *Science* 298. 1569–1579.

1569: Explicit distinction between FLB and FLN. **Only FLN includes recursion.** Key computational capacities evolved for reasons other than communication. Here, I presume Chomsky refers to language as a tool for the free expression of unbounded thought (this is his hobby horse, I guess), but he does not say this explicitly.

1570: “In particular, animal communication systems lack the rich expressive and open-ended power of human language (based on humans' capacity for recursion).”

1571: Core part of FLN: Computational system (narrow syntax). Generates (or *creates*, the mathematical usage of this term here surely is peripheral) internal representations and maps them to interfaces (A-P and C-I). External limitations to FLN: lung capacity, working memory etc.

1572-73: Three hypotheses on nature of FLB/FLN. Obviously, they go with hypothesis three: **Only FLN is uniquely human.** Short period of development. This could open the way to questioning FLN as an adaptation. Note that this is *not anti-adaptationist*: Adaptation should only be invoked if other explanations fail. “Onerous concept”. Narrow syntactic component satisfies efficient computation.

1574: Certain aspects of the faculty of language are considered as “spandrels”, following an idea by Gould and Lewontin. A-P system: The special status of speech is emphasized: Other species of mammals also have a descended larynx – in this respect, the physiology of the human larynx is not that special.

- Just as we had it with the E&L (Evans and Levinson (2009), at the time of writing this summary) article: There, our vocal tract was something absolutely uniquely human. This, apparently, is not the case. Hauser et al. (2002) quote a paper by Fitch (2001) without going into the details.

The descended larynx might just be a classical case of Darwinian pre-adaptation. Check this - I don't know too much on this. *An adaptation for something that could potentially be useful?* (Don't worry too much on this concept – only interesting for the evolutionarily involved.)

1575: C-I System: Though animals may display particular features of rich mental

representations (dominance relations etc.), these concepts are not externalized, or only in a very coarse way.

1576: Five features of animal communication systems. Cries are not words. Only humans display **discrete infinity**.

1577: Human numeral capacity: “In particular, these chimpanzees required thousands of training trials, and often years, to acquire the integer list up to nine, with no evidence of the kind of 'aha' experience that all human children of approximately 3.5 years acquire.” No long-distance hierarchical relationships in animal communication systems.

1578: Recursion may be found in non-communicative domains (Theory of Mind etc.). A possible thesis could be that these domains used to be impenetrable and thus highly modular (if one assumes that impenetrability correlates somehow with modularity). *As with humans, it could be that this encapsulated domain was transformed and became domain-general, providing humans with the application of recursion to other cognitive areas (thought and thought externalization). Perhaps all complex organisms (noncommunicatively) display some form of recursion and only humans can use it across domains.*

A longer quote:

“If we find evidence for recursion in animals, but in a noncommunicative domain, then we are more likely to pinpoint the mechanisms underlying this ability and the selective pressures that led to it. [...] During evolution, the modular and highly domain-specific system of recursion may have become penetrable and domain-general. This opened the way for humans, perhaps uniquely, to apply the power of recursion to other problems.”

### References

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