Syntactic Order for Free: Self-Organization & Emergent Complexity at the heart of the Human Language faculty and "humaniqueness"

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Abstract. Taking the influential, reductionist characterization of the human language faculty by Hauser, Chomsky, and Fitch (2002), I argue that a separationist approach to this central cognitive attribute faces challenges that a more emergentist position avoids. I then turn to a characterization of natural language syntax as a complex dynamic system that is capable of producing attested structures (here claimed to be Turing patterns) in the absence of traditional lexical supervision. The contribution concludes with an analysis of the cognitive ecology of the language faculty, and how language relates to/interfaces with mental modules.

Keywords: language faculty, syntax, complex systems, reductionism, emergentism, interface

1 The problem with divide-and-conquer approaches

In this paper I intend to examine a central human cognitive attribute, the language faculty—for many, the source of our incredibly complex mental life—and argue for a characterization of it that is more emergentist, and that puts more emphasis on its cognitive "ecology" than more standard accounts.

The point of departure of my argument will be the influential (2002) *Science* paper by Hauser, Chomsky, and Fitch, which outlines a research program for biolinguistics that crucially rests on a divide-and-conquer approach. According to these authors, more light can be shed on the nature, development, evolution of the human language faculty if the latter is divided into two parts: a so-called Faculty of Language in the Broad sense (FLB), and a Faculty of Language in the Narrow sense (FLN). FLB is defined as those aspects of the language faculty that are neither specific to language nor specific to humans. FLN is defined as those aspects of the human language faculty that are both specific to language

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and unique to humans.

Although sympathetic to Hauser, Chomsky and Fitch's treatment of the language faculty as a non-monolithic object, I would like to argue that the specificity of human language cannot be studied independently of those aspects that make up FLB, for there are reasons (discussed below) to believe that what is specific to language is the way it conjoins pre-existing (non-linguistic) abilities (i.e., the set that FLB defines). Put another way, FLN, so I wish to argue, reduces to the set characterized as FLB by Hauser, Chomsky and Fitch.

Crucially, saying that FLB is what ties all the aspects of FLB together does not mean that FLN equals FLB, or that FLN is empty. As is the case with many emergent phenomena, the whole is more than the sum of its parts. This is exactly what I wish to argue: once evolution made it possible to tie all the aspects of FLB together, it created a specific cognitive ecology, an environment where generic processes (i.e., not specific to language or unique to humans) could be harnessed. Such processes will be argued to make it possible to (i) further decrease the importance of reductionist thinking in linguistics/cognitive science, (ii) shed light on linguistic meaning, and (iii) offer a more realistic prospect for an eventual unification with cognitive neuroscience.

2 Against Linguistic preformationism

Contemporary theoretical linguistics suffers from remnants of pre-formationist thinking. It typically adopts a reductionist-computational approach that attributes all sources of syntactic order (most prominently, headed hierarchical structures, but also semantic relations) to linguistic atoms ("word-like" elements called lexical items) and their irreducible properties called features. Such features have come to code for each and every interesting property of human language. Without such features it is fair to say that no structural relations could be established. Such features have a very high degree of linguistic specificity, and pose important, though rarely discussed evolutionary challenges. In addition, some of these features are said to function like switches (with binary settings) that serve as the source for the great linguistic variation observed among humans (so-called 'parameters'). All of this is pre-specified in lexical items, which thereby act as programs that help compute the linguistic organism in pretty much the same way geno-centric approaches view the role of genes in the computation of the organism, and the sources of variation and selection.

I would like to argue for a Gestalt shift in this area of study, and posit as an important source of (syntactic and semantic) order the sort of mechanisms that are now well established in complex systems. In various publications (Boeckx (2008, 2009, In press)) I have argued that much of the syntactic and semantic order that previous linguistic studies have identified and attributed to lexical items can be reconstructed "for free" as a result of the interplay of two mechanisms: a very generic, iterative, set-forming operation dubbed *Merge* and a periodic Transfer mechanism (called *Spell-Out*) that communicates the output of Merge to the cognitive systems with which the language faculty interfaces.

The joint operation of Merge and Spell-Out is akin to a reaction-diffusion mechanism of the sort first investigated by Turing (1952). In effect, natural language syntax is argued to be a dissipative structure.

Crucially, for the dissipative structure to emerge, there must be an abundance of lexicalized concepts, whose supply keeps natural language away from equilibrium (in effect, at the edge of chaos). The availability of lexicalized concepts (the density of the lexical community, as it were) is the initial condition that facilitated the emergence of the language faculty, and which I want to see as a correlate of brain growth. (The well-known long-range neural connectivities found in *homo sapiens* plausibly underlie the abundance of lexicalized concepts.) No computational instruction needs to be provided. All there has to be is a sufficient amount of concepts that the language faculty can combine at will (giving rise to the well-known property of discrete infinity.)

3 'Humaniqueness'

Let us now return to the cognitive uniqueness of human beings. In the words of Hauser (2009),

> [a]nimals share many of the building blocks that comprise human thought, but paradoxically, there is a great cognitive gap between humans and animals. By looking at key differences in cognitive abilities, [we hope to] find the elements of human cognition that are uniquely human. The challenge is to identify which systems animals and human share, which are unique, and how these systems interact and interface with one another.

Hauser presents four evolved mechanisms of human thought that give us access to a wide range of information and the ability to find creative solutions to new problems based on access to this information:

1. the ability to combine and recombine different types of information and knowledge in order to gain new understanding;
2. to apply the same rule or solution to one problem to a different and new situation;
3. to create and easily understand symbolic representations of computation and sensory input; and
4. to detach modes of thought from raw sensory and perceptual input.

Details of formulation aside, Hauser's hypothesis is a very familiar one. The essence of Hauser's claim really goes back to the Descartes' fascination with human cognitive flexibility, its fluidity, its detachment from perception, and its unbounded character—in short, its creative character. This is what led the Cartesians to claim that Man has no instinct, by which they meant that Man's cognitive faculties rise above the *hic and nunc*. This too was clear to Konrad Lorenz, who said that "man is a specialist in not being specialized." (Lorenz (1959)) As Marc Hauser likes to put it, while other animals display laser-beam-like intelligence (highly precise specificity), humans intelligence is floodlight-like

(generalized specificity) in character.

To be sure, scientists have found that some animals think in ways that were once considered unique to humans. For example, some animals have episodic memory, or non-linguistic mathematical ability, or the capacity to navigate using landmarks. In sum, animals have a rich mental life, full of modules or what E. Spelke calls 'core knowledge systems.' What Man seems to have in addition is the ability to systematically transcend the boundaries of modular thought and engage in cross-modular concept formation.

I would like to claim that this ability of building bridges across modules is directly related to the view of language sketched above. Specifically the ability to lexicalize concepts (uprooting them from their modules) and combine them freely via Merge (itself a very generic, set-formation operation, not specific to the language faculty). The emergence of lexical items (non-modular conceptual projections) was the sort of perfect storm that gave Man his niche (an example of niche-construction). Once concepts are dissociated from their conceptual sources by means of a lexical 'envelope', the mind truly becomes algebraic, and stimulus-free.

The creation of the human lexicon is what lies behind the creative aspect of our thought process. With language, creativity emerged, understood (as did Arthur Koestler) as "the sudden, interlocking of two previously unrelated skills or matrices of thought," an almost limitless capacity for imagination, metaphorical extension, etc.

One need not follow Hauser (2009) in positing four distinct mechanisms to account for humaniqueness. One key event (the emergence of this ability to lift the concepts away from their modular restrictions) suffices. Going back to Hauser's four ingredients for human specificity listed above, we can now claim that by means of lexical envelopes, humans are able to "detach modes of thought from raw sensory and perceptual input," and lexicalize at will ("create and easily understand symbolic representations of computation and sensory input"). Via Merge, humans have "the ability to combine and recombine different types of information and knowledge in order to gain new understanding, and apply the same rule or solution to one problem to a different and new situation."

With lexical items freely available and combinable ("Merge"), the human mind became capable of true swiss-army-knife style cognition. Before that the tools at the animal's disposal were exquisitely tuned to their tasks, but too isolated. Their effects could only be combined sequentially; they could not be seamlessly and smoothly integrated with one another. With language, the human mind developed into a key ring, where all keys (concepts) can be combined and available at once, thanks to the hole (edge feature) that they all share.

Words gave Man a truly general language of thought, a *lingua franca*, where before there were only modular mutually incomprehensible dialects ((proto-)languages) of thoughts. It significantly altered Man's conceptual structures—how humans think the world. By merging lexicalized concepts, Man was able to hold in mind concepts of concepts, representations of representations, and associations of associations. *Homo* became *Homo combinans*.

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