

## Order but no Structure in Bonobo English

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Generative research since the 1950s has focused on the relationship between order and structure: for example, one major difference between regular grammars and context-free grammars is that the latter, but not the former, can assign some nontrivial hierarchical constituent structure to a string of terminal elements. However, Merge, as originally defined by Chomsky, is notably incapable of representing either order or nontrivial structure. Chomsky's Merge is an operation that, initially, takes two elements from the numeration and forms a set from them, and subsequently, takes one element from the numeration and forms a set from that element and the previously formed syntactic object. This recursive application of Merge is already sufficient to yield a discrete infinity, but it gives no representation of order (these are unordered sets) and, if the numeration consists only lexical items, no representation of nontrivial constituent structure. In fact, in one sense, structures created by Merge alone are weaker than those that can be generated by regular grammars.

Not surprisingly, then, most of the action in minimalist research concentrates on other operations. Most importantly for our purposes, order is created by linearisation of the terminals of the unordered set created by Merge. This linearisation can also in principle create some non-finite-state structures, if the LCA doesn't hold (e.g. (1a), created by Merge, may be linearisable as (1b), with a mixture of left- and right-branching which cannot be represented in a regular grammar).

(1a) {a, {b, {c.d}}}

(1b) [a [[c d] b]]

However, constituent structure can be most fully represented by considering the interactions of syntactic objects created in multiple derivational workspaces. Multiple derivational workspaces are necessary whenever we have two syntactically complex sisters, as in (2): the subject NP is assembled in one workspace and then joined to the VP which has been independently assembled in the other.

(2) {{The, engineers}, {build, aeroplanes}}

This requires a more nuanced conception of recursion in the minimalist program. Much of the expressive power of natural language can only be captured by assuming something broadly along the lines of Renumeration in the sense of Johnson (2002): the numeration feeds structure-building, but this structure-building can feed back into the numeration, to be subsequently added to a *different* structure. This is recursion at a coarser grain from that given by repeated application of Merge alone.

In this talk, I contend that this coarser notion of recursion is necessary if we are to make any sense at all of Hauser, Chomsky & Fitch's (2002) claim that recursion is the core part of FLN, the uniquely human, domain-specific elements of the language faculty. My evidence comes from responses made by Kanzi, the bonobo, to 660 spoken English instructions (Savage-Rumbaugh *et al* 1993). Kanzi shows clear evidence for sensitivity to linear order, and so we have to attribute *some* syntactic ability to him. However, his comprehension falters drastically in two areas, namely NP-coordination and function words. These are the only two cases in the corpus where any reasonable syntax-semantics mapping procedure requires a notion of hierarchical constituent structure in the syntax. The natural conclusion is that Kanzi is unable to assign such structures to input strings: he can deal with order (as regulated by Merge and linearisation), but not with the type of structure that requires multiple derivational workspaces.