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arity prespecified for all possible mergers (e.g., binary Merge).

The procedure implementing n-ary Merge is thus not guaranteed to halt, generating an output, and "one cannot make productive use of a function unless one can determine the output for any permissible input" (Gallistel and King 2009: 87).

3.3 Straw Man

One could concede my argument for the incomputability of n-ary Merge, but dismiss it as otiose, the slaying of a straw man: the incomputamput

"underlying system of rules" (Chomsky 1965: 4) in the mind that "represents

therefore those abstractions exist, and really do a□ect phy

In connection with this absolute limit on physical computation is the exigency for thermodynamic stability. Because n-ary Merge does not halt to generate an output until the nth argument to be merged is retrieved (counted) from the lexicon and/or a parallel derivation, each argument < n, as it is retrieved, needs (in some connectionist models) to circulate in a reverberating memory loop, generating heat, waiting until n is reached. The problem is that

infinite one (see Chomsky 1955). Thus again is n-ary Merge intractable.

Binary Merge is tractable if any function is: its spatiotemporal resources are held constant at the absolute minimum necessary and sufficient for a function to be nontrivially generative.[1] In this natural sense of minimizing input to maximize output—expressions can be added to expressions indefinitely—binary Merge is the optimal generative function. Unlike n-ary Merge, binary Merge halts as soon as a combinatorial operation can halt.[1] Thus even a tractable n-ary Merge—a function with not "too large" an n, $n > 2$—is suboptimal vis-à-vis binary Merge.

The (potential) intractability of n-ary Merge is related to its (potential) non-compactness. Informally stated, the procedure for some function is compact if the information necessary to encode it is some significant number of orders of magnitude less than the information the procedure can generate. Bi-

In e□cient computation, neither SO is modified under merger; this can be stated as the No-Tampering Condition NTC (see Chomsky 2005). But union Merge, by design and admission (see Jackendo□ 2011), violates NTC: it erases the brackets—by an implicit associativity operation—of the complex SO(s).[2]

endo 2005) posits or, a fortiori, "had no phrase structure at all," but merely "units composed only of words linked by semantics and linear precedence rules" (Everett 2010: 7), then (i) countless complex associativity operations would need to be stipulated—and conceptually motivated—to erase the hierarchical structure binary Merge automatically generates and (ii) the e ects of hierarchy (structure-dependence) would need to be recovered; these conditions are probably unsatisfiable because (i) could be intractable and (ii) could be incomputable (see footnote 26).

Thus I am arguing that the purported evidence for non-binary-branching structures needs to be reanalyzed consistent with my theory. This is not unreasonable: to my knowledge, no syntactic structure necessitates an analysis in terms of non-binary Merge, which perhaps seems simpler than binary Merge in some instances, although really it is not. [1] Thus, contrary to the "Boasian tradition," I am arguing that language cannot be "described [...] without any preexistent scheme of what a language must be" (Joos 1957: v) (emphasis added). The preexistent scheme must assume a generative procedure, and that procedure must be assumed not to be n-ary; it ought to be assumed to be binary.

(i) XP , X

Thus a conjecture such as "For Japanese, [D-structure] is a 'flat' structure formed by [(i)]" (Chomsky 1981: 132)—and any updated version—must be false.

31 The empirical phenomena adduced in Jackendo 2011 are not problematic for simple binary Merge, but my arguments (Watumull 2012b) are too lengthy to construct here.

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The Computability and Computational Complexity of Generativity

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