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Response: Commentary: No evidence for language syntax in songbird vocalizations

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A Commentary on

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1 Introduction

Suzuki and Matsumoto (2024), SM24 henceforth, reply to our commentary (Beckers et al., 2024) on Suzuki and Matsumoto (2022), SM22 henceforth, but mostly reiterate their original position. They do not address our main points of critique, asserting that these are based on a “misunderstanding of the definition of core-Merge”, without explaining what the misunderstanding is about. This way they are simply sidestepping criticism that we raised to their original claims. Repeats do not add up to an argument. Moreover, they continue to confuse concepts that we believe are at the heart of the problem. Here we argue that SM’s use of core-Merge is incoherent and that its invocation as an explanation for the results is arbitrary and stipulatory. Furthermore, their objection to our use of the term ‘syntax’ is terminological only. We focus on what we consider the primary issues, i.e., core-Merge, its ontology in animal call systems and its role in evolution of language.

2 Critical commentary

2.1 Core-Merge

The notion core-Merge and SM24’s description of it – “the simple binary combinatorial device that *concatenates* two syntactic atoms (lexical items) into a *set*” or “a capacity which allows senders to *combine* two meaning-bearing calls into a *sequence*” [our italics] – are incoherent. Merge (i.e., set formation, which yields hierarchical structure but imposes no linear order) and concatenation (i.e., an operation of rewrite systems yielding string-based linear order

only) belong to different mathematical models, viz. Merge-grammars (generating free magmas) and Rewrite grammars (generating monoids) respectively (Berwick and Chomsky, 2019). SM's discussion thus leads to incoherence and mathematical fallacy. See Marcolli et al. (In press) for precise and detailed discussion. The distinction between commutative, non-associative magmas (set-formation) and non-commutative, associative monoids (concatenation) is not without consequences. Core processes of human language overwhelmingly rely on hierarchical structure, ignoring linear order (Everaert et al., 2015; Chomsky, 2021; Chomsky et al., 2023). This position is also held in Fujita (2009, 2014), on which SM base their discussion. Merge uniquely explains this hierarchical structure, an automatic consequence of its application. This contrasts sharply with findings in animal communication, which so far can be explained based on linear strings of call sequences. Describing these in terms of a hybrid and incoherent notion of core-Merge does not do much to explain the case.

2.2 Evolution

SM22's claim that recursion added to core-Merge is what yields Merge in human language explicitly follows Fujita's line of argumentation (Fujita, 2009, 2014). So here lies the specific evolutionary relevance downplayed in SM24. As a point of interest, the reply is submitted to the *Ecology & Evolution* branch of *Frontiers*. In fact, while it is not said *verbatim* that core-Merge is the first step toward human language, SM22 do say that "this study [...] also has important implications for the studies of language evolution" and that "determining [...] what specific mechanisms provide the basis for the emergence of hierarchical structure [...] will deepen our understanding on the evolutionary pathway of language" [our italics]. These text passages have been conveniently left out in SM24, which now states that there is no "insisting on a specific trajectory of language evolution." However, since the authors argue that core-Merge with 'Labeling' added yields recursive Merge (see Discussion below), their core-Merge must be an important step in a specific trajectory of language evolution. SM24's objection to our commentary only evades the question.

2.3 Syntax

SM24 object that they never used the term 'language syntax' or even 'syntax.' However, in the formal study of language and mathematical linguistics, 'syntax' is nothing more than manipulation of symbols in a computation (see Everaert et al., 2015; Schlenker et al., 2023). Using core-Merge, Merge, or concatenation to combine 'recruitment' (R) and 'alert' (A) into AR is plain syntax. The use of the term 'syntax' is thus neutral here. So, 'language syntax' merely denotes handling symbols in a computational system for (natural) language. Objecting to this is only objecting to terminology and creates a problem where none exists. We simply argued that Merge computation in human language has not been shown to have antecedents in animal communication. Specifically, core-Merge is not a candidate. That conclusion still stands.

2.4 Why Merge?

Not only are R and A combined, according to SM22 they are combined by core-Merge. But the combination AR can be the result of several processes. The finite alarm system can be produced or accepted by any kind of finite state automaton or (equivalent of a) rewrite system. The simplest bigram scanning devices suffice, even listing might do. Why then is core-Merge *necessary* for AR? It is just one out of many options. There is no argument in SM22, only arbitrary stipulation. Moreover, if core-Merge is set-formation, the merge result {A, R} in addition needs linearization to produce the call sequence AR. So, the question arises, if we need linearization anyway, what is the motivation for set-formation? Concatenation suffices. The situation is opposite to human language, where hierarchical structure prevails and linear order is ancillary (see section 2.1.).

3 Discussion

Core-Merge increases the call repertoire A, R by one more call, viz. AR. A and R are 'atoms' that are combined to yield {A, R}. Following Fujita (2014), core-Merge is assumed to be an initial stage in a trajectory whose final stage is what he calls Recursive Merge and yields hierarchical structure. For Fujita, the result {x, y} of merging x and y requires application of a further Labeling process in human language that yields {z, {x, y}} with label z = x or y. Labeling atomizes the product, which therefore becomes a new object to which core-Merge may apply, thus, in this approach, instantiating recursive application. Quoting Fujita (2014) "[W]hile Core-Merge yields a set of two syntactic atoms, Label identifies this newly formed set with one of its members, turning it to another syntactic atom to which Core-Merge can apply again." Since bird calls do not have the 'atomizing' process of labeling that is required for recursive application, absence of recursion in animal communications would be accounted for.

However, the argument does not hold. (Recursive) Merge must be able to also apply to *unlabeled* structures to explain prevalent empirical results. Successive cyclicity and displacement generally would incorrectly be ruled out otherwise. One such successive-cyclic effect can be observed in German *Wen glaubst du [wen sie getroffen hat -]* ("Who do you believe she has met?"). Another effect is that without successive cyclic rule application the so-called *wh*-island violation illustrated in ill-formed **What did she wonder [who looked at -]* could no longer be explained by biologically plausible resource restrictions such as Subjacency (Chomsky, 2019, 2021).

These properties constitute core elements in the formal study of human language. In modern explanatory models of language, labeling is dissociated from Merge, e.g., to explain empirical effects of deep-seated ('universal') principles like the extended projection principle ('clauses must contain a subject') and empty category principle ('non-overt constituents must be recoverable'); see Chomsky (2015). Consequently, recursivity does not follow from a labeling effect but is a necessary property of a computational procedure carrying the computation forward (Chomsky, 2017;

Berwick and Chomsky, 2019); for further discussion see Chomsky et al. (2023).

Of course, one is free to use the term (core-)Merge as a descriptive term for ‘combining’ any two calls (e.g., A and R) into a single unit (here, AR). But that description does not relate to the explanatory and enabling function of Merge in Strong Minimalist theories of human language. See Chomsky (2019) and for later developments, Chomsky (2021) and Chomsky et al. (2023). Then why confuse the issue? Why not say that AR is the combination of A and R, posing a compositionality issue (Schlenker et al., 2023), without suggesting any (ontological, evolutionary) relevance for (recursive) Merge of natural language syntax? Birdsong and alarm call are internal computational systems with externalized use but, obviously, externalization does not entail merge. All along, we must keep in mind that our interest is primarily in explaining the internal structure of the device (‘explanatory adequacy’) rather than describing some regularities of the call strings (‘descriptive adequacy’).

4 Conclusion

SM24 repeats the conclusions of SM22 but argument by repetition does not answer our objections, and far less explains their own findings. SM22 present an experimentally observed and undisputed call combination that has no direct implications for the study of language evolution and, in our view, does not deepen our understanding on the evolutionary pathway of language sketched by Fujita (2009, 2014) and adopted by SM22/24. We agree that SM22 can be used against a ‘separate utterances’ approach of call combinations as discussed in Schlenker et al. (2023), who note that discussion of “the specific compositional rule that [SM22] take to be involved” is lacking but would be “helpful to [...] delineate the compositional theory from the ‘separate utterances’ view.” As argued in our commentary (Beckers et al., 2024), so far, the computational primitives of human language and animal call systems seem to have opposite properties along relevant

dimensions. While the absence of evidence for some property need not mean evidence for its absence, these opposite properties provide support for the lack of Merge in non-human animal communication, thus explaining the lack of support for Merge in animal communication systems (Berwick and Chomsky, 2016). Call combination in birds provides no clues for language evolution.

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