Against usage-based approaches to recursion: The grammar-performance distinction in a biolinguistic perspective

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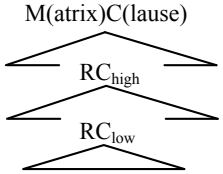
Keywords: syntax; processing; recursion; center-embedding; third factor

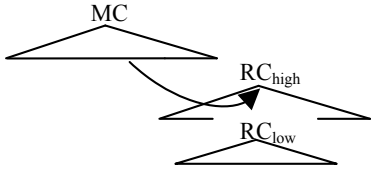
The distinction between grammar and performance distinguishes the biolinguistic approach to language from other cognitive accounts such as usage-based theories that also aim at a biological explanation of the human language faculty (cf. Christiansen & Chater 2008). One prominent argument, initially developed by Chomsky & Miller (1963), in favor of drawing a sharp distinction between processing operations on the level of performance and formal mechanisms on the level of grammar is the observation that unbounded recursive structures cannot successfully be interpreted despite being generable by the grammar. However, it has recently been argued in a usage-based setting that constraints on recursive structures do not follow from extrinsic limitations on memory or processing but from intrinsic constraints of the system in which the knowledge of grammatical regularities is embedded. In this paper, we will provide both empirical evidence and conceptual arguments against such approaches to the grammatical property of unbounded recursion.

In the first part of the paper, we turn to Christiansen & MacDonald's (2009) connectionist implementation of a usage-based approach to recursion. They trained a 'Simple Recurrent Network' (SRN) on recursive center-embedded structures and claimed that the SRN develops human-like processing of recursive constructions, and that this model is thus able to predict patterns of human performance. Crucially, they hypothesize that externally specified limitations on memory or processing cannot fully explain patterns of human performance, since their SRN predicts a significant effect of depth of recursive embedding that cannot be attributed to potential length effects. Regarding this hypothesis, we draw on recent empirical evidence from both a corpus study and an experiment testing acceptability using a speeded grammaticality judgment task (cf. Trotzke *et al.* in press; Bader subm.); the four sentence types investigated in these studies are shown in (1):

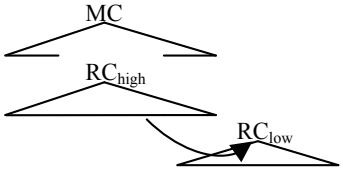
(1) a. RC_{high} and RC_{low} center-embedded



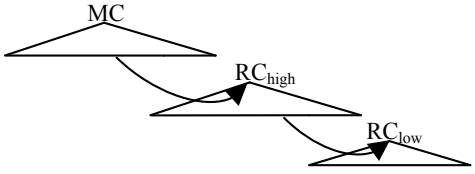
b. RC_{high} extraposed, RC_{low} center-embedded



c. RC_{high} center-embedded, RC_{low} extraposed



d. RC_{high} and RC_{low} extraposed



Our aim was to find out whether German sentences containing doubly center-embedded relative clauses (RCs) have unique properties attributable to the high degree of recursive center-embedding, as Christiansen & MacDonald's (2009) model would predict. To answer this question, the corpus study included not only sentences containing doubly center-embedded RCs (1a) but also three additional sentence types in which the degree of center-embedding was reduced to either one ((1b) and (1c)) or zero (1d) by means of RC extraposition. The re-

sults summarized in (2) suggest that the two possible applications of extraposition – within the superordinate clause and within the higher relative clause – are independent of each other.

(2) Bader (subm.: Table 14)

	Degree of CE	RC high	External properties	RC low	Internal properties
sentence type (1a)	2	+ CE	long post-NP region Subj antecedent	+ CE	long post-NP region
sentence type (1c)	1	+ CE	long post-NP region Subj antecedent	– CE	short post-NP region
sentence type (1b)	1	– CE	short post-NP region Obj antecedent	+ CE	long post-NP region
sentence type (1d)	0	– CE	short post-NP region Obj antecedent	– CE	short post-NP region

It is for this reason that doubly center-embedded RCs have no unique properties. Instead, they share properties with sentences containing the same kind of disrupted dependency: sentences with center-embedded RCs of type (1c) as far as the properties of the superordinate clause are concerned, and sentences with extraposed RCs of type (1b) as far as the properties of the higher RC are concerned. The corpus evidence was corroborated by an experiment that investigated the acceptability of the very same sentence structures that were the topic of the corpus study. Thus, in contrast to the predictions of Christiansen & MacDonald's (2009) SRN, our data support the *Disrupted-Dependency Hypothesis* that all constraints on center-embedding follow from the fact that center-embedding disrupts syntactic dependencies.

In a biolinguistic context, it has been claimed that approaches such as Christiansen & MacDonald's (2009) model "speak to how processing and knowledge of language are fundamentally intertwined in a way not well-captured by traditional approaches in formal language theory" (de Vries *et al.* 2011: 29). Recently, however, it has been shown for the domain of language acquisition that data from frequency-oriented linguistics can fruitfully be connected to current conceptions of UG (cf. Yang 2010). In the second part of our paper, building on our arguments against usage-based approaches to recursion, we will argue that systematic properties of performance systems can play an important role within the biolinguistic perspective on language by providing third-factor explanations for crucial design features of human language. In particular, we will propose a typology of explanatory strategies that address properties of the performance interface and, as we will argue, show points of convergence with Chomsky's (2005) three-factor parcellation (cf. Trotzke *et al.* in press).

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