Non-parallelism of grammatical encoding and decoding due to shared working memory

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On-line assembly of syntactic structures is part and parcel of both sentence production ("grammatical encoding") and sentence comprehension ("grammatical decoding"). According to standard assumptions, these tasks are subserved by separate cognitive processing resources. However, psycholinguistic research has uncovered substantial similarities between grammatical encoding and decoding. E.g., both are lexically guided, incremental, constraint-based; both are affected by syntactic priming and grammatical (in)congruence, etc. Such commonalities can be explained on the assumption that grammatical encoding and decoding operate on the basis of a shared working memory for grammatical processing. This account predicts that language users are unable to assemble and maintain in working memory two distinct syntactic trees simultaneously, one for a perceived input sentence and one for a self-produced output sentence (except maybe for very simple sentences). We designed a voice-RT dual-task paradigm requiring concurrent decoding (reading) and encoding (paraphrasing, editing). Participants read sentences such as (1) presented in fragments at 1200ms intervals (slashes mark fragment boundaries; Dutch was the target language).

The fragments appeared at the lefthand side of the computer screen. In some trials, however, the subordinator "that" appeared at the righthand side, signaling onset of the paraphrasing task: henceforth, the sentence should be completed as indirect speech. I.e., in response to type-(1) sentences, the participants actually produced semantically identical but syntactically different type-(2) sentences. In half the trials, the input sentences were presented with "himself," which is incorrect and may delay the decoding process. However, "himself" fits perfectly in the output sentences, eliminating the need to replace the input reflexive. In a single-task control condition, participants read aloud the type-(1) sentences.

Ungrammatical input reflexives were found to delay RTs in the reading-only control condition. Crucially, no trace of this delay was observed in the reading-and-paraphrasing condition: What mattered here was the input reflexive's fit in the sentence under construction, not its fit in the sentence being read. In another study using a pluralization task, we obtained similar results with number-congruent and number-incongruent subject-verb pairs.

Apparently, while grammatically encoding the target paraphrase, speakers cannot keep the decoded syntactic structure distinct from the concurrently encoded structure. This supports the idea of shared working memory resources for grammatical decoding and encoding, and entails non-parallelism of grammatical encoding and decoding.

We will argue, furthermore, that this fact cannot be explained in terms of non-linguistic (e.g. attentional) restrictions on parallel processing, and that it is compatible with the phenomena of close shadowing.

Examples

(1)   The headmaster/complained: /"I have/seen/a nasty cartoon/of/myself."
(2)   The headmaster/complained/that/he had/seen/a nasty cartoon/of/himself.