

Linguistic rhythm guides syntactic structure building reading data and an OT-style incremental processing model

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In written text comprehension, the task of the reader is to assign the printed word sequence a sufficiently coherent syntactic structure to allow semantic analysis. At the same time, readers generate from the graphemic string an intrinsic auditory version of the text, entailing rich prosodic structure. Various reading studies have revealed that this ‘implicit prosody’ may affect the syntactic analysis of written text (e.g. [1,2]). The role of ‘implicit prosody’ in written sentence comprehension, however, has been described as paradoxical [3]: on the one hand, prosody is shaped according the syntactic structure of the word string, suggesting that the syntactic analysis determines the prosodic representation; on the other hand, experimental evidence attests a clear influence of ‘implicit prosody’ on the syntactic analysis proper.

The following research questions guide our attempt to clarify the syntax–prosody interaction in reading:

1. At what stage do prosodic factors constrain the incremental syntactic analysis?
2. How can this interaction be modeled with respect to a performance compatible competence grammar?

In a controlled reading experiment, using sentences like (1), we tested the influence of stress-based linguistic rhythm on syntactic ambiguity resolution.

- (1) a. ...nicht mehr {NACHweisen, erMITteln} kann, wer der Täter war.
 ...couldn’t {*prove, determine*} *anymore who the culprit was.*
 b. ...nicht MEHR {nachweisen, ermitteln} kann, als die Tatzeit.
 ...couldn’t {*prove, determine*} *more than the date of the crime.*

The ambiguity concerns the word *mehr* featuring either an unaccented temporal adverbial (1-a) or an obligatorily accented, comparative complement to the verb (1-b). The rhythmic-prosodic environment was systematically varied at the verb following *mehr* with either initial or medial stress. Accented comparative *mehr* followed by a verb with initial stress in the citation form involves a stress clash, violating the (supralexical) prosodic constraint *CLASH.

Eye-tracking data from a silent reading experiment reveal that readers exhibit significantly higher processing difficulties at the disambiguating clause in the comparative reading when the verb features initial stress, suggesting that readers initially compute the unaccented temporal *mehr* in this condition to avoid a stress

clash. Thus, at points of syntactic underspecification, the accruing prosodic representation may affect even the earliest stages of structure building in reading, viz. the analysis of syntactic features on the ambiguous word. Such an effect remains inexplicable in the context of (psycho-) linguistic theories that assume a strictly unidirectional relationship between syntactic and phonological processes, the latter merely interpreting the conditions the syntactic component imposes.

The performance data are modeled as an incremental constraint satisfaction process in the framework of an OT parsing account (cf. [4,5]). Solely making use of constraints from competence grammar, the model is capable of capturing the data and advocates the simultaneous application of syntactic, prosodic and syntax-phonology interface constraints in incremental processing. The model predicts that, at points of syntactic indetermination, weak prosodic constraints alone may guide syntactic structure assignment. The OT grammar/processor integrates syntactic parsing and prosodification in reading, hence dissolving the strict separation of language production and comprehension. At the same time the OT model endorses a bidirectional relationship between syntax and phonology in grammar.

References

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