The Processing of PP-Attachment Ambiguity in German – The Influence of Explicit Prosody and Verb Placement

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Three experiments were conducted to investigate whether and when the explicit prosodic structure of an utterance influences the processing of prepositional phrase (PP) attachment ambiguity in German. Moreover, it was examined which constraints drive attachment preferences, e.g. availability of lexical heads (e.g. Konieczny et al., 1995), minimality principles (e.g. Frazier, 1987), or prosodic boundary information (*Prosodic Structuring*, Zschernitz, 2011, following Speer, Kjelgaard, and Dobroth, 1996; and as previous research, e.g. by Speer et al., 1996, Snedeker & Trueswell, 2003, indicates). A variety of empirical on-line and off-line methods was used to answer these questions.

In all three studies, two factors, *prosody* and v*erb placement,* were varied. The manipulation of prosody featured two patterns of boundary marking each of which was associated with either attachment of the ambiguous PP[1]. For the manipulation of verb placement, sentences with the finite verb either in second or in sentence-final position were created. Materials are illustrated under (1) – (4), hash marks (#) indicate prosodic boundaries[2]. In Experiment 3, a sentence completion study, items as those under (1) – (4) were employed, which had been cut after the direct object noun (*Igel*).

The results of Experiment 1, an off-line forced choice categorisation study, showed clear evidence that prosodic boundary marking was used by the listeners to resolve ambiguity. Additionally, an underlying preference for VP-attachment was observed. These two effects showed up independently of the verb placement manipulation.

On-line visual-world data (Experiment 2) yielded a reliable prosodic effect on fixations to picture referents time-locked with the occurrence of prosodic cues in the signal for verb-second conditions. This indicates that prosodic cues are employed to guide parsing decisions[3]. Conversely, results of verb-final structures, showed no reliable prosody effect. As descriptive tendencies indicate, nonetheless, prosody cannot be completely neglected as a factor of influence in the processing of verb-final sentences. Fixation data for both verb-final conditions yielded a late NP-attachment preference predicted by the availability of lexical attachment sites.

Sentence completion data (Experiment 3) replicated the prosodic effects for verb-second conditions. Smaller and less complex phrases were preferentially added in NP-modifying prosody conditions (when sentence fragments do not end in a major prosodic boundary), whereas VP-modifying prosody conditions (sentence fragments end with a major boundary) exhibited a reliable increase in completions with larger and more complex phrases. Therefore, the categories of completed phrases mirror listeners' sensitivity for the prosodic manipulation. No effect of prosody was found for verb-final structures. As in Experiment 1,

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[1] Materials were constructed avoiding biasing any of the possible attachment types. This was controlled for in a number of pre-tests. Additionally, materials were controlled for typicality of direct object noun and PP-noun co-occurrences.

[2] For illustration purpose, structure is given in a simplified way.

[3] It should be noted that none of the participants reported having been aware of the ambiguity and the prosody manipulation.

an overall VP-attachment preference of the completed phrases was discovered. No evidence for a general NP-attachment preference of completions was found in verb-final sentences.

Although results on the processing of verb-final structures are mixed (and we are intrigued to know why), our data provide further evidence that explicit prosodic cues are used during incremental processing to build a prosodic representation that can guide parsing decisions, speaking in support of *Prosodic Structuring*.

Examples:

(1) Verb-second structure, NP-modifying prosody
[$_S$[$_{NP}$ *Der Junge*] [$_{VP}$[$_V$ *berührt gleich*] # [$_{NP}$[$_{NP}$ *den Igel*] [$_{PP}$ *mit der Birne*]]]]
'The boy touches soon the hedgehog with the pear.'

(2) Verb-second structure, VP-modifying prosody
 [$_S$[$_{NP}$ *Der Junge*] [[$_{VP}$[$_V$ *berührt gleich*] [$_{NP}$ *den Igel*]] # [$_{PP}$ *mit der Birne*]]]
'The boy touches soon the hedgehog with the pear.'

(3) Verb-final structure, NP-modifying prosody
[$_S$[$_{NP}$ *Der Junge*] [$_{VP}$[$_V$ *überlegt*]
[$_S$ *ob er gleich* # [$_{NP}$[$_{NP}$ *den Igel*] [$_{PP}$ *mit der Birne*]] # [$_V$ *berühren soll*]]]]
'The boy considers whether he soon the hedgehog with the pear touch should.'

(4) Verb-final structure, VP-modifying prosody
[$_S$[$_{NP}$ *Der Junge*] [$_{VP}$[$_V$ *überlegt*]
[$_S$ *ob er gleich* [$_{NP}$ *den Igel*] # [$_{VP}$[$_{PP}$ *mit der Birne*] [$_V$ *berühren soll*]]]]]]
'The boy considers whether he soon the hedgehog with the pear touch should.'

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