

A prosodic resolution of German case ambiguities

Tina Bögel

University of Konstanz

Tina.Boegel@uni-konstanz.de

In recent years, the nature of the interaction between syntax, semantics and prosody has been discussed with increasing interest in LFG (Butt and King 1998, O'Connor 2005, Mycock 2006, Bögel et al. 2009, Dalrymple and Mycock 2011, Bögel 2012) and the necessity of including prosody as an independent correspondence structure has been argued for. However, the precise representation of the p-structure remains a matter of further research. In this paper we adopt the p-diagram introduced by Bögel (2012). The p-diagram provides a theory-independent and compact description of the speech signal. In particular, the p-diagram allows for an easy extraction of relevant information for other correspondence structures and can be adjusted to language- and theory-specific needs. This is demonstrated with respect to German word order and ambiguous case marking.

The type of ambiguity at stake is illustrated in (1), where the ambiguity in the subordinate clause is due to the ambiguous feminine article of the second DP, which could either be dative or genitive.

- (1) Alle erwarteten, dass
 Everyone expected that
- [die Tochter]_{DP1} [der Wirtin]_{DP2} widersprechen würde
 the.ART.FEM.NOM daughter.FEM the.ART.FEM.DAT/GEN landlady.FEM dissent would
- 'Everyone expected that ... the daughter would dissent from the landlady_{dat}/
 ... the daughter of the landlady_{gen} would dissent.'

Previous work has shown that speakers use prosodic cues to disambiguate examples as in (1). This process often involves more than one aspect of prosody and may include segmental duration, fundamental frequency, intensity or pauses between elements. Gollrad et al. (2010) present results which indicate that the German case ambiguity is resolved mainly by means of duration and only partly by the fundamental frequency (f0). In particular, their results show no significant effects of the fundamental frequency on the second DP (*die Wirtin* in (1)). However, Gollrad et al. (2010) only evaluated the maximum f0 peak of the *whole* DP. They did not distinguish between the syllables within the DP. In contrast, a case study conducted for this paper showed a significant effect of the fundamental frequency, when the f0 peak was measured for each syllable. For the second syllable in a disyllabic trochaic word, the fundamental frequency in the dative construction was on average 44 Hz lower than the respective f0 in the genitive construction ($\beta=-44$, $SD=19.17$, $t\text{-value}=-2.3$).

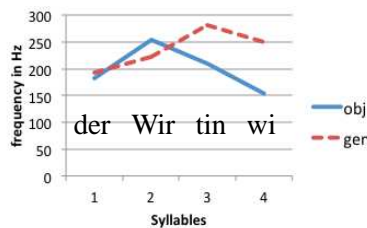


Figure 1: The fundamental frequency of *die Wirtin* for the genitive vs. the dative-object.

The difference between the two syllables is thus crucial for the correct interpretation of an orthographically ambiguous sentence. This has been further verified by a small reception experiment, in which the listeners were able to distinguish the genitive from the dative on the basis of the f0 distribution within the second DP.

The syllable-based p-diagram approach of Bögel (2012) allows for the necessary fine-grained interpretation of the orthographically ambiguous second DP. In (2), the p-diagram representations for the dative (2a) and the genitive (2b) are given for the second DP (*der Wirtin*).

(2) a. The dative construction

Vector	...	...	...	...	...
	Fund. Freq.	-	H*	-	...
	Stress	-	prim	-	...
	Syllables	/de: ^v /	/vɪ: ^v /	/tɪn/	...
	Vectorindex	S ₁	S ₂	S ₃	...

b. The genitive construction

Vector	...	...	...	...	...
	Fund. Freq.	-	-	H*	...
	Stress	-	prim	-	...
	Syllables	/de: ^v /	/vɪ: ^v /	/tɪn/	...
	Vectorindex	S ₁	S ₂	S ₃	...

On the bottom line of the p-diagram, the syllables are indexed. On top of the individual syllables are the different layers of the speech signal information corresponding to this particular syllable, in this case fundamental frequency, lexical stress and the IPA representation. The p-diagram formally consists of vectors, which can be extended as needed to include other aspects of the speech signal, like pause or intensity. With reference to the syllable (or a group of syllables), the related speech signal information can be accessed. For case disambiguation, the relevant information is the fundamental frequency: For the dative ((2a)), the H* indicates a peak of the fundamental frequency¹ on the first syllable of *Wirtin*, while for the genitive ((2b)), the peak is encoded on the second syllable. In principle, this information on f0 can be combined with other prosodic aspects of the p-diagram, e.g. duration or pauses after the interval in question.

This information can then be used by syntax to disambiguate between the two alternative syntactic structures. As similarly proposed by Dalrymple and Mycock (2011), the string simultaneously projects to p(honological)-structure and c-structure. S(yntactic)-string and p(honological)-string are two sides of one coin, with the p-string representing the speech signal. S-string and p-string are interfaced by the lexicon, which functions as a look-up instrument and provides the relevant phonological, morphosyntactic and semantic information. The relation between c- and p-structure is defined by $\rho(\pi^{-1}(f))$, which allows for c-structure to include information from p-structure, in this case information on the fundamental frequency. Figure 2 shows the prosody-syntax interface for the two DPs *die Tochter der Wirtin* ‘the daughter of the landlady’. The c-structure analysis is based on the German ParGram grammar (Dipper 2003).

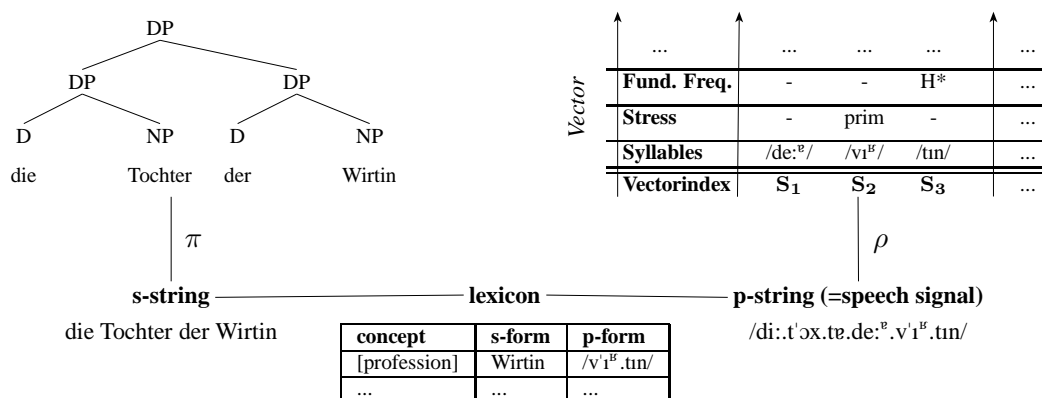


Figure 2: The prosody-syntax interface

The respective c-structure rule for the genitive version in Figure 2 is shown in (3).

$$(3) \text{ DP} \rightarrow \text{DP} \quad \text{DP} \\ (\uparrow_{\pi^{-1}\rho} S_{max} \text{ FUND.FREQ.}) =c \text{ H}^* \\ (\downarrow \text{ CASE}) = \text{gen}$$

The inverse relation of π ($\uparrow_{\pi^{-1}}$) describes the relation between c-structure and s-string. The relation of p-string to p-structure is defined via the relation ρ , which is composed with π^{-1} ($\uparrow_{\pi^{-1}\rho}$). In our example, the attribute value pair FUND.FREQ= H* refers to the f0 value of the DP's maximum (=last) syllable and is used as a constraint so that the genitive can only be realised if there is a H* in the last syllable of the noun.

In conclusion, this paper argues for a fine-grained prosodic system, which includes different aspects of the signal on the basis of the corresponding syllable and thus allows for facts like the genitive/dative-object distinction via the fundamental frequency to be captured and used for disambiguation within c-structure.

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¹H* is part of the ToBI annotation conventions (Silverman et al. 1992), indicating a high tone peak.

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