

### **German Pre-Nominal Modifiers As Clues In Machine Translation**

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From items that precede a noun in a German noun phrase (NP) we obtain a great amount of information. Much of the information is redundant, much of it seems irrelevant within the area of English morphology. But what is superfluous morphologically, may become significant on the syntactic level.

Nouns can be preceded by adjectives. These may be primary adjectives with so-called strong endings, some of which are ambiguous, others specific. Or they may be secondary adjectives featuring the so-called weak endings, which even more frequently are ambiguous. In the case of adjectives with secondary endings there must be another item preceding which belongs to a group that we may call the *der*-words, or limiting words. Among the *der*-words we list all those that cause secondary endings in a following adjective, such as *der, die, das, dieser, jener, eine, keine, mancher, solcher, welcher* and their inflected cases. The *der*-words, however, may also be the *only* items preceding a noun. Among primary adjectives we list all those that take endings themselves, but do not cause secondary endings in a following adjective, i.e. the usual comparable adjectives as well as *mehrere, viele, wenige, einige, andere, etliche, verschiedene*.

Moreover, nouns can be preceded by items with zero-endings, like *ein, kein, welch, solch, manch*, also the possessives and numerals. This group may occur alone before a noun, or preceding another adjective without causing secondary endings.

From the noun itself we obtain information about number, gender, and case. Number is of immediate relevance for translation into English. If we cannot obtain information on number from the form of the German noun, i.e. if the plural morpheme is zero (*Fenster, Schüler*), the identification becomes more complicated and search for clues outside the NP may become necessary. Gender is not rendered in English, but case is syntactically relevant, and it may be that case becomes identifiable only by reference to gender. For example, the NP *der Fenster* is identified as a gen.pl. by reference to the fact that *Fenster* is a neuter noun.

The information, then, offered by the German NP for translation into English concerns number and case. We obtain such data by a combination of clues which in isolation are quite often unspecific. Even with all the NP data combined, the identification has often to be sought elsewhere, i.e. in the verb, the word order, etc.

The greatest amount of information is yielded by the noun itself. The noun must be coded in the glossary with all the information that it supplies. Some of this information is specific, some is not. *Mannes* is specific as to gender, number, and case. *Frau* is specific in gender and number, but not in case. *Schüler* is specific in gender only.

As regards other items in the NP, there is only one specific primary adjective ending, namely *-em*, which denotes sg.dat. The fact that it may be masc. or neuter does not impair its specificity for translation. In the category of limiting words, specific information is carried by the ending *-em* and by the word *des* (not by the ending *-es*, since in *dieses*, *jenes*, etc. there is ambiguity). Through secondary adjectives alone, no unambiguous identification is possible.

Since the nouns carry at least some specific information regularly, it is felt that the search for complete data should begin there and proceed backwards through the NP.

The following is an attempt to outline the steps that have to be taken in machine translation to identify the NP as to case, and where the plural morpheme is zero, as to number. It will become clear in the process where the NP does not yield sufficient data for complete identification.

A preceding preposition may have to be referred to for identification of case. It is not included here in the NP because it is often linked with a verb or adjective, in which case it may call for a lexical correspondence in English that does not contain a preposition (e.g. *sich erinnern an*—to remember).

Upon encountering a *masc. noun in the sg.*, look for preceding adjective.

If yes, look for *-e* ending

if yes, NP is nom. (Include preceding der-word) *der kleine Herr*

if no, look for <i>-en</i> ending	
if yes, look for preceding <i>des</i> -word	
if yes, NP is gen.	des kleinen Herrn
if no, look for <i>dem</i> -word	
if yes, NP is dat.	dem kleinen Herrn
if no, look for <i>den</i> -word	
if yes, NP is acc.	den kleinen Herrn
if no, look for gen. suffix in the noun	
if yes, NP is gen.	guten Mutes
if no, NP is acc.	guten Mut
if no, look for <i>-er</i> ending	
if yes, NP is nom. (Include preceding zero-word, if any)	(ein) kleiner Herr
if no, look for <i>-em</i> ending	
if yes, NP is dat.	grossem Fleiss
If no, look for preceding <i>der</i> -word	
if yes, NP is nom.	der Herr
if no, look for <i>des</i> -word	
if yes, NP is gen.	des Herrn
if no, look for <i>dem</i> -word	
if yes, NP is dat.	dem Herrn
if no, look for <i>den</i> -word	
if yes, NP is acc.	den Herrn
if no, look for preceding zero-word	
If yes, NP is nom.	ein, kein, mein, unser Herr
If no, look for preceding preposition	
If yes, NP is non-nominative case	mit Mut, durch Fleiss
If no, clue is outside NP	Mann, Mut, Fleiss (nom. or acc.)
Upon encountering a <i>masc. noun in the pl.</i> , look for preceding adj.	
If yes, look for <i>-e</i> ending	
if yes, look for preceding acc.prep.	
if yes, NP is acc. (Include zero-word, if any)	für (zwei) alte Herren
if no, clue is outside NP	(zwei) alte Herren (n. or acc.)
if no, look for <i>-er</i> ending	
if yes, NP is gen. (Incl. zero-word, if any)	(zwei) alter Herren



if no, look for <i>-en</i> ending	
if yes, look for limiting word	
if yes, look for <i>des</i> -word	
if yes, NP is gen.sg.	des kleinen Schülers
if no, look for <i>dem</i> -word	
if yes, NP is dat.sg.	dem kleinen Schüler
if no, look for <i>die</i> -word	
if yes, look for acc.prep.	
if yes, NP is	
acc.pl.	für die kleinen Schüler
if no, NP is pl., but clue for case is outside NP	die kleinen Schüler (nom. or acc.)
if no, look for <i>der</i> -word	
if yes, NP is gen.pl.	der kleinen Schüler
if no, look for <i>den</i> -word	
if yes, look for dat.pl. suffix in the noun	
if yes, NP is dat.pl.	den kleinen Schülern
if no, look for preceding acc. prep.	
if yes, NP is acc. sg.	für den kleinen Wagen
if no, look for dat.prep.	
if yes, NP is dat.pl.	bei den kleinen Wagen
if no, clue is outside NP	den kleinen Wagen (acc.sg. or dat.pl.)
if no limiting word, look for gen. suffix in noun	
if yes, NP is gen. sg.	guten Willens
if no, look for dat.pl. suffix in noun	
if yes, NP is dat.pl.	kleinen Schülern
if no, look for preceding acc.prep.	
if yes, NP is acc.sg.	ohne kleinen Wagen
if no, look for dat.prep.	
if yes, NP is dat.pl.	mit kleinen Wagen
if no, clue is outside NP	kleinen Wagen (acc.sg. or dat.pl.)
if no <i>-en</i> ending, look for <i>-er</i> ending	
if yes, look for preceding zero-word	
if yes, NP is nom. sg.	ein, mein, kleiner Fehler
if no, look for gen.prep.	
if yes, NP is gen.pl.	wegen kleiner Fehler
if no, clue is outside NP	kleiner Fehler (nom.sg. or gen.pl.)

if no, look for <i>-em</i> ending	
if yes, NP is dat.sg.	kleinem Fehler
If no preceding adj., look for limiting word	
If yes, look for <i>der</i> -word	
if yes, look for preposition	
if yes, NP is gen.pl.	wegen der Fehler
if no, clue is outside NP	der Fehler (n.sg. or g.pl.)
if no, look for <i>des</i> -word	
if yes, NP is gen. sg.	des Fehlers, des Studenten
if no, look for <i>dem</i> -word	
if yes, NP is dat.sg.	dem Fehler
if no, look for <i>den</i> -word	
if yes, look for dat.pl. suffix in noun	
if yes, NP is dat.pl.	den Fehlern
if no, look for prec.dat.prep.	
if yes, NP is dat.pl.	mit den Wagen
if no, look for acc.prep.	
if yes, NP is acc. sg.	ohne den Wagen
if no, clue is outside NP	den Wagen (acc.sg. or dat.pl.)
if no, look for <i>die</i> -word	
if yes, look for preposition	
if yes, NP is acc.pl.	ohne die Fehler
if no, clue is outside NP	die Fehler (nom. or acc.pl.)
If no limiting word, look for word with zero-suffix	
If yes, look for numeral	
if yes, look for preposition	
if yes, NP is non-nominative pl.	für, wegen, mit zwei Wagen
if no, NP is pl., but clue for case is outside NP	
if no, look for <i>ein</i> -word	
if yes, NP is nom.sg.	zwei Wagen (nom. or acc.)
If no zero-word, clue is outside NP	ein, mein, unser Wagen Wagen, Schüler, Fehler (nom.acc.sg.pl.)
Upon encountering a <i>fem.noun in the sg.</i> , look for preceding adj.	
If yes, look for <i>-e</i> ending	

if yes, include preceding <i>die</i> -word, if any, and look for acc. preposition if yes, NP is acc.	ohne (die, eine) junge Frau
if no, clue is outside NP	(die, eine) junge Frau (nom. or acc.)
if no, look for <i>-en</i> ending if yes, include preceding <i>der</i> -word and look for gen. prep. if yes, NP is gen.	wegen der (dieser, etc.) jungen Frau
if no, look for dat.prep. if yes, NP is dat. if no, clue is outside NP	mit der jungen Frau der jungen Frau (gen. or dat.)
if no, look for <i>-er</i> ending if yes, look for gen.prep. if yes, NP is gen. if no, look for dat.prep. if yes, NP is dat. if no, clue is outside NP	wegen grosser Not  mit grosser Not grosser Not (gen. or dat.)
If no adj., look for preceding limiting word If yes, look for <i>die</i> -word if yes, look for acc.prep. if yes, NP is acc. if no, clue is outside NP	für die (eine, etc.) Frau die (eine, etc.) Frau (nom. or acc.)
if no, look for <i>der</i> -word if yes, look for gen.prep. if yes, NP is gen.  if no, look for dat.prep. if yes, NP is dat.  if no, clue is outside NP	wegen der (einer, dieser) Frau  mit der (einer, dieser) Frau der (einer, dieser) Frau (gen. or dat.)
If no limiting word, look for prep. If yes, NP is in non-nominative case If no, clue is outside NP	mit Not, für Mutter Not, Mutter, Frau (nom., gen., dat., acc.)

Upon encountering a <i>fem. noun in the pl.</i> , look for preceding adj.	
If yes, look for <i>-e</i> ending	
if yes, (include preceding numeral, if any, and look for acc. preposition)	
if yes, NP is acc.	für (drei) junge Frauen
if no, clue is outside NP	(drei) junge Frauen (nom. or acc.)
if no, look for <i>-en</i> ending	
if yes, look for preceding limiting word	
if yes, look for <i>die</i> -word	
if yes, look for acc.prep.	
if yes, NP is acc.	für die (diese, manche, etc.) jungen Frauen
if no, clue is outside NP	die jungen Frauen (n. or acc.)
if no, look for <i>der</i> -word	
if yes, NP is gen.	der (dieser, etc.) jungen Frauen
if no, look for <i>den</i> -word	
if yes, NP is dat.	den (diesen, etc.) jungen Frauen
if no limiting word, NP is dat. (incl. preceding numeral, if any)	(drei) jungen Frauen
if no, look for <i>-er</i> ending	
if yes, NP is gen. (incl. preceding numeral, if any)	(drei) junger Frauen
If no preceding adj., look for limiting word	
If yes, look for <i>die</i> -word	
if yes, look for acc.prep.	
if yes, NP is acc.	für die (diese, etc.) Frauen
if no, clue is outside NP	die (diese, etc.) Frauen (nom. or acc.)
if no, look for <i>der</i> -word	
if yes, NP is gen.	der (dieser, etc.) Frauen
if no, look for <i>den</i> -word	
if yes, NP is dat.	den (diesen, etc.) Frauen
If no limiting word, look for prep.	
If yes, NP is in non-nominative case (incl. numeral, if any)	- mit, für (drei) Frauen



If no, look for dat. pl. suffix  
 If yes, NP is dat.  
 (incl. numeral, if any) (drei) Müttern, Töchtern  
 If no, clue is outside NP (drei) Frauen (nom.,  
 dat., acc.)

Upon encountering a *neuter noun in the sg.*, look for preceding adj.  
 If yes, look for *-es* ending  
 if yes, (incl. preceding zero-word if any, and)  
 look for acc. preposition  
 if yes, NP is acc. ohne (ein, mein, solch,  
 etc.) kleines Kind  
 if no, clue is outside NP (ein, etc.) kleines Kind  
 (nom. or acc.)

if no, look for *-e* ending  
 if yes, (incl. preceding *das*-word and) look  
 for acc. prep.  
 if yes, NP is acc. für das (welches,  
 dieses) kleine Kind  
 if no, clue is outside NP das (welches, etc.)  
 kleine Kind  
 (nom. or acc.)

if no, look for *-en* ending  
 if yes, look for preceding limiting word  
 if yes, look for *des*-word  
 if yes, NP is gen. des (dieses) kleinen  
 Kindes  
 if no, look for *dem*-word  
 if yes, NP is dat. dem (diesem) kleinen  
 Kind (e)  
 if no limiting word, NP is gen. letzten Endes  
 if no, look for *-em* ending  
 if yes, NP is dat. gutem Geld

If no adj., look for limiting word  
 If yes, look for *das*-word  
 if yes, look for acc. prep.  
 if yes, NP is acc. für das (welches,  
 dieses) Kind  
 if no, look for gen. suffix in the noun  
 if yes, NP is gen. welches, dieses Kindes  
 if no, clue is outside NP das (welches, dieses)  
 Kind (nom. or acc.)

if no, look for <i>des</i> -word	
if yes, NP is gen.	des (eines, meines) Kindes
if no, look for <i>dem</i> -word	
if yes, NP is dat.	dem (einem, diesem) Kind(e)
If no limiting word, look for zero-word	
If yes, look for acc. preposition	
if yes, NP is acc.	für ein (kein, mein) Kind
if no, clue is outside NP	ein (kein, etc.) Kind (nom. or acc.)
If no zero-word, look for prep.	
If yes, NP is in non-nominative case	für, mit, wegen Geld
If no, clue is outside NP	Geld (nom., dat., acc.)
Upon encountering a <i>neuter noun in the pl.</i> , look for preceding adj.	
If yes, look for <i>-e</i> ending	
if yes, (incl. preceding numeral, if any, and)	
look for acc. preposition	
if yes, NP is acc.	für (zwei) kleine Kinder
if no, clue is outside NP	(zwei) kleine Kinder (nom. or acc.)
if no, look for <i>-er</i> ending	
if yes, NP is gen. (incl. numeral, if any)	(zwei) kleiner Kinder
if no, look for <i>-en</i> ending	
if yes, look for preceding limiting word	
if yes, look for <i>die</i> -word	
if yes, look for acc. prep.	
if yes, NP is acc.	für die (diese, solche) kleinen Kinder
if no, clue is outside NP	die (diese, etc.) kleinen Kinder (nom. or acc.)
if no, look for <i>der</i> -word	
if yes, NP is gen.	der kleinen Kinder
if no, look for <i>den</i> -word	
if yes, NP is dat.	den kleinen Kindern, den blauen Augen
if no limiting word, NP is dat.	
(include numeral, if any)	(zwei) blauen Augen

If no adjective, look for limiting word	
If yes, look for <i>die</i> -word	
if yes, look for acc. preposition	
if yes, NP is acc.	für die (manche) Kinder
if no, clue is outside NP	die (diese, manche, etc.) Kinder (nom. or acc.)
if no, look for <i>der</i> -word	
if yes, NP is gen.	der (dieser, etc.) Kinder
if no, look for <i>den</i> -word	
if yes, NP is dat.	den (diesen, etc.) Augen
If no limiting word, look for preposition	
If yes, NP is in non-nominative case (incl. numeral, if any)	für, mit, wegen (zwei) Augen
If no preposition, look for dat. pl. suffix in the noun	
If yes, NP is dat. (incl. numeral, if any)	(zwei) Kindern
If no, clue is outside NP	(zwei) Augen (nom., dat., acc.)
Upon encountering a <i>neuter noun with no indication of number</i> (i.e. with zero or ambiguous plural morpheme), look for preceding adj.	
If yes, look for <i>-e</i> ending	
if yes, look for preceding <i>das</i> -word	
if yes, NP is sg.	
look for acc. prep.	
if yes, NP is acc. sg.	durch das (dieses, welches) kleine Fenster
if no, clue for case is outside NP	das (dieses, etc.) kleine Fenster (nom. or acc.)
if no <i>das</i> -word, NP is pl.	
look for acc. prep.	
if yes, NP is acc. pl.	durch kleine Fenster
if no, clue for case is outside NP	kleine Fenster (nom. or acc.)
if no, look for <i>-er</i> ending	
if yes, NP is gen. pl. (include numeral, if any)	(zwei) kleiner Fenster
if no, look for <i>-es</i> ending	
if yes, NP is sg. (incl. preceding zero-word, if any, and) look for acc. preposition	
if yes, NP is acc.	ohne (ein, solch) kleines Fenster

if no, clue for case is outside NP	(ein, solch, welch) kleines Fenster (nom. or acc.)
if no, look for <i>-em</i> ending	
if yes, NP is sg. dat.	kleinem Mädchen
if no, look for <i>-en</i> ending	
if yes, look for limiting word	
if yes, look for <i>des</i> -word	
if yes, NP is sg. gen.	des kleinen Mädchens
if no, look for <i>dem</i> -word	
if yes, NP is sg. dat.	dem kleinen Mädchen
if no, look for <i>die</i> -word	
if yes, NP is pl.	
look for acc. prep.	
if yes, NP is acc.	ohne die kleinen Mädchen
if no, clue for case is outside NP	die (diese, etc.) kleinen Mädchen (nom. or acc.)
if no, look for <i>der</i> -word	
if yes, NP is pl. gen.	der kleinen Mädchen
if no, look for <i>den</i> -word	
if yes, NP is pl. dat.	den kleinen Mädchen
if no limiting word, look for gen. sg. ending in noun	
if yes, NP is gen. sg.	kleinen Mädchens
if no, NP is dat. pl.	kleinen Mädchen
If no adj., look for preceding limiting word	
If yes, look for <i>das</i> -word	
if yes, NP is sg.	
look for acc. prep.	
if yes, NP is acc.	für das (dieses, etc.) Mädchen
if no, clue for case is outside NP	das (dieses, etc.) Mädchen (nom. or acc.)
if no, look for <i>des</i> -word	
if yes, NP is sg. gen	des (dieses, eines) Mädchens
if no, look for <i>dem</i> -word	
if yes, NP is sg. dat.	dem (diesem, einem) Mädchen
if no, look for <i>der</i> -word	

if yes, NP is pl. gen.	der (dieser, mancher) Mädchen
if no, look for <i>den</i> -word	
if yes, NP is pl. dat.	den (diesen, manchen) Mädchen
if no, look for <i>die</i> -word	
if yes, NP is pl.	
look for acc. prep.	
if yes, NP is acc.	für die Mädchen
if no, clue is outside NP	die (diese, etc.) Mädchen (nom. or acc.)
If no limiting word, look for zero-word	
If yes, look for numeral	
if yes, NP is pl.	
look for preposition	
if yes, NP is in non-nominative case	für, wegen, mit zwei Mädchen
if no, clue for case is outside NP	zwei Mädchen (nom. or acc.)
if no, look for <i>ein</i> -word	
if yes, NP is sg.	
look for acc. prep.	
if yes, NP is acc.	für ein (mein, kein) Mädchen
if no, clue for case is outside NP	ein (mein, kein) Mädchen (nom. or acc.)
If no zero-word, look for preceding preposition	
If yes, NP is non-nominative pl.	für, wegen, mit Mädchen
If no, clue for number and case is outside NP	Mädchen (nom., dat., acc. sg.; nom., gen., dat., acc. pl.)