

The Production of Noun Phrases: A Cross-linguistic Comparison of French and German

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Abstract

Two experiments investigated the grammatical encoding processes during the production of noun phrases consisting of an article, an adjective, and a noun. Experiment 1 shows that for noun phrases in German, with the adjective in prenominal position, the lemmas of the noun and the adjective, and the noun's grammatical gender are selected before utterance onset. Experiment 2 shows that for noun phrases in French, with the adjective in postnominal position, only the noun lemma and its grammatical gender are selected. This suggests that grammatical advance planning at the level of grammatical encoding can operate with the smallest full phrase which can be expanded rightwards during articulation. Furthermore, the data show that gender is selected irrespective of whether it surfaces in the eventual phonological form of the noun phrase or not. This result is in line with the assumption that the grammatical encoder operates independently of the phonological encoder.

Introduction

Psycholinguistic models of language production assume that the production of an utterance occurs in several processing steps. The major processing stages are conceptualization, grammatical encoding, phonological encoding, and articulation (e.g., Levelt, 1989; Levelt et al., 1999). For the description of a colored line drawing by means of a noun phrase like "the red table", the main processing steps are as follows. On the basis of the pictorial input, the abstract lexical entities (so-called lemmas) for the adjective and the noun have to be retrieved from the mental lexicon. For languages marking the grammatical gender of nouns by gender marked articles and / or gender marking inflections on the adjective (e.g., German, Dutch, and French), the noun lemma activates the lexical-syntactic information about the noun's grammatical gender. This information is also assumed to be stored in the mental lexicon and is used to select so-called agreement targets. In the case of definite determiner noun phrases in German, the gender marked definite determiner is the agreement target. For the corresponding noun phrases in French, the definite determiner and the inflectional ending of the color adjective are agreement targets. The result of these grammatical encoding processes is a syntactic representation. In the next step, this representation is passed to the phonological encoder, resulting in a phonetic plan which guides the

articulation of the noun phrase.

The present study reports experiments on the grammatical encoding processes for the production of French and German noun phrases consisting of a definite determiner, a color adjective and a noun. Although simple in syntactic structure, these noun phrases require the retrieval of a lexical-syntactic feature of the noun lemma, i.e. its grammatical gender. The grammatical gender is used to determine specific gender agreement targets like gender marked definite determiners and gender marked inflections of the adjective. As these noun phrases can easily be elicited in an experimental setting by asking subjects to name colored line drawings of common objects, they provide an interesting window for the experimental study of grammatical encoding processes in language production.

Noun phrases in French and German differ in two aspects that are of central interest for the present study. First, the noun phrases in the two languages differ in word order. Whereas in German, the color adjective occurs in prenominal position (e.g., *der grüne Tisch* the (masc) green table (masc)), it occurs in postnominal position in French (e.g., *la table verte* - the (fem) table green (fem.)). In French, the first part of the noun phrase ("la table") is a perfectly grammatical and complete phrase which can be expanded rightwards by the color adjective. By contrast, in German, the first part of the noun phrase (e.g., "*der grüne*") does not constitute a complete phrase (though it can occur in certain elliptical utterances). Thus, it appears that in German, the complete noun phrase has to be grammatically encoded before phonological encoding and articulation can be initiated, i.e. the noun lemma, the adjective lemma, and the noun's grammatical gender have to be retrieved from the mental lexicon. By contrast, in French, it might be possible that phonological encoding and articulation can already be initiated right after completion of the grammatical encoding of the first complete phrase ("la table"). The grammatical encoding for the remainder of the noun phrase, i.e. the retrieval of the adjective lemma, could be carried out while the first part of the noun phrase is processed at the phonological and articulatory levels.

Second, in German, the noun's grammatical gender always surfaces in the eventual phonological form of a noun phrase in the form of different definite determiners for the different types of grammatical gender. In French, by

contrast, the grammatical gender does not always surface in the eventual phonological form of the noun phrase. For example, in the noun phrase "la table verte" the gender marking surfaces in the phonological form of the determiner and of the adjective. However, in a noun phrase with a noun starting with a vowel and an adjective which does not change its phonological form as a function of grammatical gender (e.g., "rouge" - red), the phonological form of the noun phrase does not contain any reflection of the grammatical gender of the noun (e.g., "l'assiette rouge" - the red plate).

The critical question is whether the grammatical gender of the target noun is also selected if this lexical-syntactic property of the noun has no consequences for the eventual phonological form of the noun phrase. According to the model proposed by Levelt (1989; Levelt et al., 1999) this should be the case because the grammatical encoding processes (lemma retrieval and gender selection) are assumed to strictly precede phonological encoding. That is, they are assumed to be modular and completely blind with respect to the noun phrase's eventual phonological shape. However, recently, Caramazza (1997, see also Caramazza & Miozzo, 1997) has proposed an alternative model of lexical processing in language production. At least in principle, this model allows for gender selection to be skipped if the grammatical gender of the noun has no consequences for the phonological form of the noun phrase. According to this independent network model (IN-model), the phonological form and the lexical-syntactic properties of words (like a noun's grammatical gender) can be looked up independently from each other and in parallel. This has important potential implications for noun phrases for which the phonological form of the definite determiner and the adjective does not depend on the noun's gender. If the retrieval of the phonological forms can be completed before selection of the grammatical gender has been completed, the selection of grammatical gender may not occur before utterance onset or may even be skipped completely. If this is the case, we should not obtain empirical evidence for gender selection for this type of noun phrases. Barbaud et al. (1982) have provided evidence which could be interpreted in this way. In a corpus of spoken Canadian-French, gender agreement errors were more frequent for agreement targets (like gender marked adjectives) agreeing with a noun starting in a vowel than for agreement targets agreeing with a noun starting in a consonant. This could suggest that a noun's gender is sometimes not selected if it is not needed for the determination of the phonological form of the noun's local syntactic context.

In summary, we will investigate two questions. First, does the amount of advance planning in grammatical encoding vary as a function of word order differences between French and German? More specifically, are the noun lemma, its grammatical gender, and the adjective lemma retrieved before initiation of phonological encoding in both languages, or do speakers of French only retrieve the noun lemma and its grammatical gender before initiating articulation? Second, is grammatical gender always

selected, irrespective of whether it surfaces in the phonological form of a gender agreement target in the noun phrase (e.g., a definite determiner), or can gender selection be skipped if the gender marking does not surface in the phonological form of the utterance.

These questions were addressed by means of an extension of the picture-word interference paradigm that allows us to obtain empirical evidence for lemma selection and for the selection of the grammatical gender of a noun.

With respect to gender selection, the present experiments extend previous research on the production of noun phrases in Dutch (Schriefers, 1993; see also van Berkum, 1997; LaHeij et al. 1998). In these experiments, subjects were asked to name colored line drawings as quickly as possible by means of noun phrases consisting of a gender marked determiner, a prenominal color adjective and a noun. In addition, they were presented (visually or auditorily) with so-called distractor words which they were instructed to ignore. The results showed that a distractor word which had a different grammatical gender than the to-be-produced target noun (hereafter gender-incongruent distractor, INC) prolonged utterance onset latencies relative to a distractor word which had the same gender as the target noun (hereafter gender-congruent distractors, CON). This gender interference effect is assumed to be due to a competition between the gender of the distractor and the gender of the target noun in the INC condition and leads to a prolongation of the selection of the gender of the target noun relative to the CON condition.

Lemma selection in the picture-word interference paradigm is reflected in a so-called semantic interference effect. The naming latency for the picture of an object (e.g., a chair) is prolonged in the presence of a semantically related distractor word (e.g. table) relative to a condition with unrelated distractor words (e.g., car). This effect is assumed to be due to the fact that a semantically related distractor (hereafter SEM) introduces an additional lexical competition in the selection of the to-be-produced target lemma relative to an unrelated distractor (hereafter UNR, e.g., Roelofs, 1992; Schriefers et al., 1990).

Experiment 1: Production of noun phrases in German

In this experiment, native speakers of German named colored line-drawings by noun phrases with a definite determiner (e.g., der grüne Tisch - the (masc.) green table (masc.)). In addition, they were auditorily presented with distractor words. There were 18 critical target objects from three semantic categories, with 6 exemplars per category. Within each category, each of the three grammatical genders (feminine, masculine, neuter) was represented by two object names. Each target object could occur in one of five different colors. In four distractor conditions, the distractor words were nouns. They were either semantically related to the target noun (SEM), or unrelated (UNR), and they had either the same gender as the target noun (CON) or a different gender (INC). The crossing of the factors semantic relatedness (SEM, UNR) and gender relation

(CON, INC) yields four distractor conditions. The distractors were assigned to the target objects such that each specific distractor contributed equally to each of the four distractor conditions.

In two additional distractor conditions, the distractors were adjectives. In one of these conditions, the distractor was a color adjective which was different from the one to-be-produced in the target utterance (hereafter SEM-A). In the other condition, the adjective did not have any semantic or phonological relation with any of the words in the target utterance. These UNR-A distractors were matched with the color adjectives for word length and frequency. Finally, in the so-called NONE condition, no distractor was presented. In addition, the point in time at which the distractor was presented (the stimulus onset asynchrony, SOA) was systematically varied across four levels, ranging from distractor presentation preceding picture onset by 150 ms (SOA -150 ms) to distractor presentation following picture onset by 300 ms (SOA +300 ms, steps of 150 ms). The critical dependent variable was utterance onset latency, measured from the onset of the colored line drawing to the beginning of the articulation of the noun phrase. Sixteen native speakers of German participated in the experiment.

Tables 1 and 2 give the mean utterance onset latencies as a function of distractor conditions and SOA.

Table 1: Mean utterance onset latencies (in ms) as a function of conditions with nouns as distractors and SOA in Experiment 1 (percentage of errors in parentheses)

	SOA			
	-150	0	+150	+300
NONE	713 (2.8)	710 (4.5)	708 (5.2)	697 (6.2)
SEM-CON	776 (3.8)	785 (4.9)	776 (4.2)	723 (5.9)
SEM-INC	771 (4.9)	804 (8.7)	795 (6.9)	725 (5.2)
UNR-CON	756 (5.9)	784 (3.1)	764 (4.5)	719 (2.4)
UNR-INC	747 (6.2)	766 (3.1)	793 (5.9)	718 (3.5)

The results for the conditions with noun distractors were analyzed in separate ANOVAs per SOA with the crossed factors semantic relatedness (SEM, UNR) and gender relation (CON, INC). At SOA -150 ms, there was a significant main effect of semantic relatedness, i.e. a semantic interference effect ($F(1,15) = 8.35, p < .05, F(2,17) = 5.4, p = .05$). Neither the main effect of gender relatedness nor the interaction were significant, showing that the semantic interference effect was independent of the gender relation between target noun and distractor.

At SOA +150 ms, we obtained a gender-interference effect, ($F(1,15) = 12.2, p < .01, F(2,17) = 17.2, p < .001$). This gender-interference effect was independent of the factor semantic relatedness as indicated by the absence of an effect of this factor and an interaction. At an SOA of 0 ms,

we only obtained a significant interaction of the two factors ($F(1,15) = 10.6, p < .01, F(2,17) = 4.5, p < .05$). At SOA +300, neither the two main effects nor their interaction were significant. The comparison of the utterance onset latencies for the conditions SEM-A and UNR-A was significant at SOA +150 ms ($F(1,15) = 9.0, p < .01, F(2,17) = 6.0, p < .05$).

Table 2: Mean utterance onset latencies (in ms) of distractor conditions SEM-A and UNR-A in Experiment 1 (percentage of errors in parentheses)

	SOA			
	-150	0	+150	+300
SEM-A	740 (6.9)	779 (3.8)	787 (4.2)	726 (2.8)
UNR-A	747 (5.2)	765 (2.1)	756 (5.2)	719 (3.8)

These results provide empirical evidence for the three main processes of grammatical encoding in the production of noun phrases, retrieval of the noun lemma, selection of the corresponding grammatical gender, and retrieval of the adjective lemma. All three processes appear to be completed before utterance onset. The ordering of the effects along the SOA dimension furthermore suggests that the retrieval of the noun lemma precedes the selection of its corresponding gender and the retrieval of the adjective lemma. As the retrieval times for noun lemma and gender information are presumably not deterministic but rather variable between trials, the interaction of semantic relatedness and gender relation at SOA 0 ms presumably reflects the fact that we are here dealing with a mixture of trials. Some of them are still in the stage of lemma retrieval, and some of them are already in the stage of gender selection. Finally, at an SOA of 300 ms, distractors are presented too late to have any systematic influence on grammatical encoding.

Experiment 2: Production of noun phrases in French

Experiment 2 contained the same distractor conditions and SOA manipulations as the experiment on the production of German noun phrases. However, in contrast to Experiment 1, two different types of noun phrases were used as target utterances, noun phrases with an explicit reflection of the noun's grammatical gender in the eventual phonological form, and noun phrases without a reflection of the noun's gender in the eventual phonological form of the noun phrase.

There are two critical issues here. First, does the fact that the color adjective occurs in postnominal position in French lead to a situation in which only the first part of the noun phrase (i.e., determiner and noun) is planned before utterance onset? If this is the case, we should only obtain a semantic interference effect for the noun (SEM vs UNR), but not for the adjective (SEM-A vs UNR-A). Second, can the grammatical encoding processes bypass the selection of grammatical gender if grammatical gender does not surface

in the phonological form of the eventual utterance?

Eight objects with names starting in a consonant (C-nouns) and another eight objects with names starting in a vowel (V-nouns) were selected. Each object could occur in four different colors. Two of the color adjectives require an explicit phonologically and orthographically realized inflection in dependence of the noun's gender (vert (masc) / verte (fem) - green; blanc (masc) / blanche (fem) - white; inflected adjectives hereinafter), whereas the other two did not (rouge (masc or fem) - red; jaune (masc or fem) - yellow; uninflected adjectives hereinafter). The noun types and adjective types were combined such that they yielded two different types of noun phrases. Type 1 noun phrases consist of C-nouns and an inflected or uninflected adjective. Thus, they require an explicit phonological realization of the noun's gender in the definite determiner (le = masc., la = fem.). It should already be mentioned here that the type of adjective (inflected vs uninflected) did not modulate the pattern of results for these noun phrases. Type 2 noun phrases consist of a V-noun and an uninflected adjective. For these noun phrases, grammatical gender does not surface in the phonological form. Sixteen native speakers of French participated in the experiment.

Utterance onset latencies for type 1 noun phrases (C-nouns) are given in Tables 3 and 4.

Table 3: Mean utterance onset latencies (in ms) as a function of conditions with nouns as distractors and SOA in Experiment 2, noun phrases of type 1 (percentage of errors in parentheses)

	SOA			
	-150	0	+150	+300
NONE	699 (5.5)	670 (8.2)	679 (5.5)	651 (4.7)
SEM-CON	800 (6.3)	783 (6.3)	746 (6.7)	662 (7.4)
SEM-INC	794 (6.3)	781 (6.7)	779 (6.7)	689 (7.0)
UNR-CON	749 (3.9)	744 (5.1)	764 (6.2)	658 (7.4)
UNR-INC	763 (5.1)	757 (5.5)	750 (6.7)	689 (5.9)

Table 4: Mean utterance onset latencies (in ms) of distractor conditions SEM-A and UNR-A in Experiment 2, noun phrases of type 1 (percentage of errors in parentheses)

	SOA			
	-150	0	+150	+300
SEM-A	744 (8.6)	726 (6.2)	720 (5.1)	662 (5.9)
UNR-A	744 (3.9)	734 (6.2)	745 (5.5)	666 (3.1)

The results were analyzed in the same way as in Experiment 1. For the conditions with nouns as distractors, there was a significant effect of semantic relatedness at

SOA -150 ($F(1,15) = 27.55, p < .001, F(2,1,7) = 9.6, p < .05$). The main effect of gender relation and the interaction of the two factors was not significant. The same pattern obtained for SOA 0 (semantic relatedness: $F(1,15) = 16.5, p < .01, F(2,1,7) = 6.5, p < .05$). At SOA +150 ms, only the interaction between the two factors was significant in the analysis by subjects ($F(1,15) = 7.1, p < .05, F(2,1,7) = 3.5, p = .10$). At SOA +300 ms, the effect of gender relation was significant ($F(1,15) = 4.6, p < .05, F(2,1,7) = 6.5, p < .05$), with longer utterance onset latencies in the INC-condition than in the CON-condition. Neither the main effect of semantic relatedness nor the interaction of gender relation and semantic relatedness were significant. The difference between the conditions SEM-A and UNR-A was not significant at any SOA.

Tables 5 and 6 give the mean utterance onset latencies for type 2 noun phrases (V-nouns with uninflected adjectives).

Table 5: Mean utterance onset latencies (in ms) as a function of conditions with nouns as distractors and SOA in Experiment 2 for noun phrases of type 2 (percentage of errors in parentheses)

	SOA			
	-150	0	+150	+300
NONE	694 (3.9)	663 (7.0)	672 (6.2)	628 (6.2)
SEM-CON	754 (4.7)	770 (4.7)	750 (10.2)	687 (3.9)
SEM-INC	758 (7.8)	806 (5.5)	780 (7.8)	685 (5.5)
UNR-CON	716 (3.1)	742 (5.5)	748 (7.8)	689 (3.9)
UNR-INC	716 (3.9)	780 (3.9)	766 (6.2)	694 (5.5)

Table 6: Mean utterance onset latencies (in ms) of distractor conditions SEM-A and UNR-A in Experiment 2, noun phrases of type 2 (percentage of errors in parentheses)

	SOA			
	-150	0	+150	+300
SEM-A	712 (3.9)	717 (5.1)	721 (6.3)	680 (6.3)
UNR-A	741 (4.7)	728 (5.5)	738 (0.8)	684 (4.7)

For the conditions with nouns as distractors, we obtained the following statistical results. For SOA -150 ms, the effect of semantic relatedness was significant in the subject analysis and marginally significant in the item analysis ($F(1,15) = 13.1, p < .01, F(2,1,7) = 4.1, p = .08$). The effect of gender relation and the interaction of the two factors was not significant. For SOA 0 ms, both main effects were significant or marginally significant (semantic relatedness: $F(1,15) = 4.2, p = .08, F(2,1,7) = 6.4, p < .05$; gender relation: $F(1,15) = 6.7, p < .05, F(2,1,7) = 3.3, p = .10$). The

interaction of the two factors was not significant. At the remaining two SOAs (+150, +300) neither the main effects nor their interaction reached significance, although there was a trend towards a gender interference effect at SOA +150 of 24 ms across the levels of semantic relatedness ($p = .10$ in subject and item analysis). The comparison of the SEM-A and UNR-A conditions did not yield a significant difference at any of the four SOAs.

In summary, for both types of noun phrases we obtain evidence for the retrieval of the noun lemma, as indicated by the effect of semantic relatedness, and for gender selection, as indicated by the gender interference effect. However, the time courses of these effects are different for the two different types of noun phrases. In particular, the gender interference effect for type 1 noun phrases (C-nouns) is obtained at the longest SOA whereas for type 2 noun phrases (V-nouns) it already occurs at SOA 0, and in combination with an effect of semantic relatedness (though at SOA +150 ms, there is also some indication of a pure gender interference effect). As the two types of noun phrases are necessarily based on different objects, it is not clear what the reasons for these differences in time course are. Nevertheless, it is clear that gender selection occurs irrespective of whether it is reflected in the phonological form of the noun phrase or not. Furthermore, neither for type 1 nor for type 2 noun phrases is there any indication of a semantic interference effect from the SEM-A condition relative to the UNR-A condition. This is in clear contrast to the experiment on noun phrases in German.

Discussion and Conclusion

In contrast to German noun phrases with prenominal color adjectives, the production of French noun phrases with postnominal color adjectives does not require the selection of the adjective lemma before utterance onset. Rather, it appears that speakers of French start phonological encoding and articulation as soon as they have completed the grammatical encoding of article and noun which, in French, already delivers a complete noun phrase. The further rightward expansion of this noun phrase with a postnominal color adjective takes place while the speaker is about to start articulation or during articulation of the phrase consisting of determiner and noun.

These results provide evidence for the cross-linguistic variation of grammatical advance planning. It appears that the grammatical encoder constructs one full noun phrase (in French, determiner and noun; in German, determiner, adjective and noun) before passing the result to the next processing stages. If the beginning part of the to be planned utterance is a full noun phrase on its own, as in French, the further rightward expansion of this phrase by a postnominal color adjective can be done incrementally. That is, while the first part is already processed at the phonological and articulatory level, the adjective is still being processed at the level of grammatical encoding. The results for German converge with corresponding results for noun phrases with prenominal adjectives in Dutch (Schriefers, 1993) as well as in German (Schriefers et al., in press). The results for

French show that the scope of advance planning is different for noun phrases with postnominal color adjectives.

The second main issue concerned the retrieval of lexical-syntactic features like the grammatical gender of nouns. A gender interference effect was obtained irrespective of whether the noun's gender did or did not appear overtly in the eventual phonological form of the noun phrase. The gender interference effect for French noun phrases without an explicit reflection of gender in the phonological form (i.e. noun phrases of type 2, V-nouns) was somewhat weaker than the corresponding effect in German and in French noun phrases of type 1 (C-nouns), and the time course of the gender interference effects over SOAs shows some as yet unexplained variability. Nevertheless, it appears to be clear that gender selection occurs in all noun phrases investigated in the present experiments. This conclusion is further supported by results for French noun phrases consisting of a V-noun and an inflected (i.e. gender marked) postnominal adjectives. The results for these noun phrases were not presented here for reasons of space. So we can only mention that also for these noun phrases a gender interference effect and a semantic interference effect for noun distractors were obtained. Again, no semantic interference effect was obtained for the color adjectives. Thus, although the grammatical advance planning does not comprise the gender marked adjective in this latter type of noun phrases, grammatical gender is again selected despite the fact that it does not surface in the first part of the noun phrase. However, this latter type of noun phrases had a higher proportion of gender agreement errors on the postnominal inflected adjective than noun phrases consisting of a C-noun and an inflected adjective. Although the number of gender agreement errors was generally low, this result is in agreement with Barbaud et al's (1982) data on gender errors in spontaneous speech.

Overall, the results are in line with Levelt's (1989; Levelt et al. 1999) model of language production. The grammatical encoding processes appear to be blind with respect to the eventual phonological shape of an utterance; grammatical gender is selected irrespective of whether it surfaces in the phonological form of the noun phrase or not. This result can also be seen as compatible with the IN-model (Caramazza, 1997), but it gives an important constraint on the model. Even if lexical-syntactic properties of a word and its phonological form can be retrieved independently and in parallel, the lexical-syntactic properties of a word are selected if there is an agreement target in the utterance (like a definite determiner), irrespective of whether gender agreement has a reflection in the eventual phonological form of the noun phrase or not. However, the pattern of gender errors suggests that very occasionally, gender selection can be bypassed if the gender does not surface in the phonological form of the actual grammatical planning unit (i.e. determiner and noun, in French). This leads to a somewhat higher proportion of gender errors on agreement targets later on in the utterance, like inflected postnominal adjectives.

A final point concerns the relation of the present data with

recent experiments on noun phrase production in Italian by Miozzo and Caramazza (in press). In Italian, the definite determiner of masculine nouns not only depends on the noun's grammatical gender, but also on the phonology of the next word in the noun phrase. More specifically, before words starting with a "z", a "s + consonant", or an affricate, the masculine determiner is "lo", in all other cases "il" (e.g., "lo sgabello" - the stool, "il grande sgabello" - the big stool, "il treno" the train, "il grande treno" the big train). Miozzo and Caramazza propose that due to these properties Italian is a so-called "late selection language"; the determiner can only be selected in a late stage, when the phonological form of the to-be-produced noun phrase becomes available. By contrast, German is an early selection language because selection of the definite determiner exclusively depends on the noun's grammatical gender, and not on the eventual phonological form of the noun phrase. Miozzo and Caramazza (in press) propose, on the basis of a repeated failure to obtain a gender interference effect in the production of noun phrases in Italian, that the late selection status of Italian might render the gender interference effect invisible. Given this proposal, the question arises of whether French would also qualify as a late selection language. If one assumes that, for example, the two forms of the masculine determiner ("le" for C-nouns, and "l'" for V-nouns) are treated as two different determiners (just as "il" and "lo" are in the case of Italian), this might be the case. On the other hand, one could assume that French qualifies as an early selection language and that the reduced form of the determiner ("l'") is a late phonetic accommodation of the determiner "le". If the absence of a gender interference effect is taken as a clear diagnostic tool for identifying late selection languages, then, given the present results, French would not be a late selection language. However, at present it is not yet clear whether the late selection languages necessarily imply the absence of a gender interference effect. Nevertheless, the proposal of Miozzo and Caramazza (in press) is in line with the conclusions from the present experiments in so far as there appear to be clear cross-linguistic differences in the grammatical encoding processes involved in the production of noun phrases.

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