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Grammar and language production

Where do function words come from?*

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Most psycholinguistic models of language production start from a strict division between computation and memorization. Individual content words are retrieved from the lexicon, and assembled into larger structures by means of grammatical computation. Because function words are considered grammatical elements, their insertion into these structures results from computation, rather than retrieval.

We argue that this view may be incorrect, or at least incomplete. Our case rests on an analysis of the distribution of production pauses relative to function words in a corpus of production data. We demonstrate that the data are better accounted for when we assume that the cognitive status of many of the linguistic structures people produce is that of schemata, with function words serving to retrieve them from memory.

Keywords: language production, storage vs. computation, function words, grammatical schemata

1. Introduction

In this paper, we want to bring evidence from linguistic processing, in particular from language production, to bear on the issue of the proper characterization of linguistic knowledge – i.e., on views about the organization of the mental lexicon and mental grammar. The specific topic we will focus on is the question: in exactly what way are grammatical words, or ‘function words’, selected in the process of spontaneous language production, and what this implies for theories of linguistic knowledge. Both the theoretical issue and the evidence we present are actually quite straightforward, which in our opinion makes the conclusions all the more inevitable, but to our knowledge this particular connection between theory and data has so far escaped the attention of linguists and psycholinguists alike. Cognitive linguistics has so far not really developed any serious attempt to relate theoretical

ideas to processes of production, but it should – given the cognitive commitment – and we show that it actually has considerable insights to offer, especially concerning the question whether grammar and lexicon function as distinct ‘modules’ in production.

2. The roles of lexicon and grammar in a theory of language production

Any approach to what a process of language production looks like naturally assumes that such a process starts with a communicative intention – i.e., the intention to convey the content of a message rather than the intention to produce some sounds, marks on paper, or whatever (cf. Levelt 1989: 108–110). There is also a tradition, especially among linguists but also embraced by many psycholinguists, to make a distinction between so-called content words and function words. Typical examples of the former are nouns and verbs, while typical examples of the latter comprise articles, conjunctions, prepositions, and the like. As the labels ‘content’ and ‘function words’ suggest, the former are supposed to carry the (conceptual) content of what is said, while the latter are indicators of some (grammatical) function of the elements that they are attached to – i.e., (at least in their most pure form) markers of structure rather than content. To give an example, in a phrase such as, *the hunt for the escaped prisoners*, the element *for* does not in itself contribute a particular meaning, but serves to mark the phrase *the escaped prisoners* as the object of the predicate *hunt*; similarly, the definite articles serve to mark the status of the syntactic category (‘noun phrase’) of the phrases they belong to, rather than to convey some independent aspect of content.

Now this combination of ideas immediately gives rise to a question. If the language production process starts from conceptual content, and if function words do not carry semantic content themselves – as are indeed the main assumptions underlying many current theories of language production – then it cannot be content that triggers the production of function words; so what is it that gives rise to the production of function words? The natural answer that immediately suggests itself is, of course: the *structural position* for a specific function word becomes available at some point in the production process, and this is what triggers its production. This in turn leads to a new question: *how* does this structural position become available? Again, an answer seems to be readily available: the relevant structure can be produced through the application of certain grammatical rules invoked by the elements that *do* have an immediate connection to conceptual content: the content words.

It is precisely this view that has been implemented in an influential model of language production: one that may safely be said to represent the received view of the role of grammatical rules in language production (cf. Carroll

1999:208/209) – i.e., the model of Incremental Procedural Grammar (IPG), proposed by Kempen and Hoenkamp (1987), and adopted by Levelt (1989, 1999). Informally, the model assumes the following major subsystems in the overall language production process:

- (1) Conceptualization → Formulation → Articulation.

In principle, the later subsystems (Formulation, Articulation) are dependent on the ones preceding them. However, the model allows each of these processes, and possibly ‘smaller’ subprocesses, to operate in parallel to a large extent. That is, while the routines controlling the articulatory organs are doing their work for one piece of an utterance, the routines for formulation may be working on the following piece, and the conceptualizer is in fact already planning what to say next. The part that we are interested in here (as most researchers of language production are) is the Formulator. This subsystem converts conceptual structures into linguistic structures. The input to the Formulator is formed by a thought from the Conceptualizer; we do not have to be concerned here with the precise format of this input, and we will simply assume some system for representing propositions. This thought contains concepts, and it is these that set the formulation process in IPG in motion. This consists of the steps listed in Table 1 below.

First of all, we want to stress the importance of step 4 in the model: the inherent limitations of working memory (Baddeley 1990). It is an essential factor in the explanation of a very general feature of normal language production, viz. the fact that it is incremental (hence the name of the model) in that it proceeds ‘in spurts’, with pauses reflecting the workings of the production system in between. If it were not for the limitations of working memory, language production would not proceed in spurts at all – i.e., it would not be incremental, as it actually is. After all, if speakers would have unlimited processing capacity at their disposal, then utterances – or even entire texts for that matter – could be prepared in advance, and the language production process would be continuous, guided by an all encompassing production plan (Kempen & Hoenkamp 1987:203). However, since both the empirical phenomenon of pausing and the theoretical assumption of limited space in working memory are quite robust, we will also adopt this assumption; in fact, the consequent tendency of releasing working memory as soon as possible will play an important role in our argument for an alternative analysis.

Secondly, the model is maximally ‘structure building’ and ‘lexically driven’, and these two features are strongly related. The model is structure *building* in the sense that it assumes that all of the structure of grammatical strings is computed, built ‘on the fly’, and none of it is directly retrieved from (long term) memory. This is also directly related to the next point, the ‘lexical hypothesis’: there is never a direct link between the conceptual structure and a rule of grammar (and hence a piece of grammatical structure), since a call to a grammatical rule (be it a syn-

Table 1. Overview of formulation in IPG

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- 1 The mental lexicon is accessed, with the concept as address, to retrieve the linguistic element expressing it. The routines performing this task (mapping non-linguistic concepts to linguistic units) are called lexicalization procedures. Retrieval of the lexical element normally activates the entire entry, not just the phonological shape of the word but also information about its syntactic category, and its sub-categorization frame, and perhaps other information.
 - 2 Given the lexical element, especially the information about its syntactic category, the appropriate phrase structures are built by means of ‘syntactic procedures’ (if the element retrieved from the lexicon is a noun, a noun phrase is built according to the grammatical rules for noun phrases in the language, etc.).
 - 3 The output of these syntactic procedures (i.e., syntactic phrase markers / ‘tree structures’), contains functional positions; these are filled in with the appropriate bound morphemes, inflections, auxiliaries, determiners, etcetera, by means of ‘functorization procedures’.
 - 4 Results of step (3) are put out to the Articulation routines as soon as possible in order to release working memory – i.e., the limited space is made available for another formulation process as quickly as possible.
-

tactic procedure or a functorization procedure) is mediated by at least one lexical item; only the latter are directly linked to the conceptual structure in the process of language production. As Levelt put it:

The lexical hypothesis entails, in particular, that nothing in the speaker’s message will by itself trigger a particular syntactic form, such as a passive or a dative construction. There will always be mediating lexical items, triggered by the message, which by their grammatical properties and their order of activation cause the Grammatical Encoder to generate a particular syntactic structure.

(Levelt 1989:181)

These features of the model may be said to express a purely “formal” view of grammar; it specifies structural properties of linguistic utterances without considering them meaningful.

Let us illustrate these characteristics of IPG by means of some simple examples. How does the production of a simple noun phrase such as *the circumstance* proceed? By assumption, the conceptual structure contains a specification of the concept CIRCUMSTANCE and the first step in the formulation process consists of matching this non-linguistic concept with an element in the mental lexicon. The specification of the information found there (meaning, phonological shape, syntactic category, possibly other relevant information) is given partly in:

- (2) [CIRCUMSTANCE, *circumstance*, N, ...]

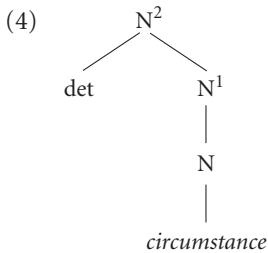
Subsequently, the information that the element expressing the concept is a noun, triggers the syntactic procedure for building a noun phrase:¹

- (3) a. $N^2 \rightarrow \text{det}, N^1$

The rule produces a structure consisting of two elements, one of which (N^1) is itself a trigger for a syntactic subprocedure, (3b):

$$(3) \quad b. \quad N^1 \rightarrow \dots N \dots$$

The output of this rule does not contain triggers for calling further syntactic procedures, and the lexical node (N) provides a point to attach the lexical item to. At this point – i.e., after lexicalization and syntactic specification but before functorization (the end of stage 2, in Table 1), working memory contains the following partially specified structure:

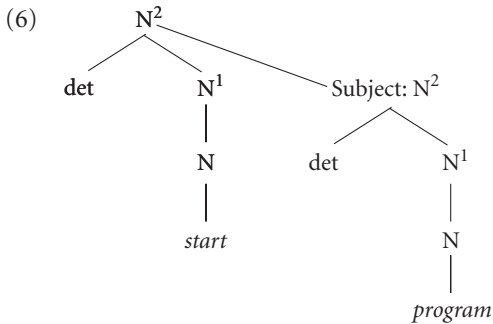


This structure contains a node for a functional element, in this case a determiner position, which functions as a trigger for a functorization procedure (stage 3, in Table 1). This procedure inspects the conceptual structure for the specification of the ‘accessibility’ (cf. Ariel 1988) or some equivalent notion of the concept involved, in order to decide between inserting either *the*, *a* or \emptyset ; supposing that the value found is +accessible, the element *the* will be inserted. As Kempen and Hoenkamp (1987:218) argue, the insertion of function words is “chiefly motivated on syntactic grounds, so they cannot be supposed to originate simply from lexicalization”. In this case, for example, it may be supposed that the realization of a determiner, such as *the*, is dependent on the presence of a Noun Phrase node in the structure being produced, and not *only* on the feature +accessible in the conceptual structure. An accessible concept expressed by an adjective or a verb should not be marked by *the*, so the determiner cannot be seen as arising directly from the conceptual structure by lexicalization of +ACCESSIBLE, in the same way as *circumstance* originates from lexicalization of CIRCUMSTANCE. The consequence of the strict separation of functorization from lexicalization and syntactic procedures (in two distinct production stages) is thus that structures of the type (4), with all of the content words and none of the function words specified, have to be taken as representing a particular and necessary stage in the production of a linguistic utterance.

To take a slightly more complicated example, consider the production of the phrase, *the start of the program*, according to this model. The relevant portion of the underlying conceptual structure will look like (5):

(5) [START (PROGRAM)]

After lexicalization and syntactic specification, the intermediate representation of the expression being produced, will look something like:²



It is on the basis of this representation, containing all content words and a complete specification of the phrase structure, that the production process enters stage 3, in which functorization results in the addition of *the*, *of*, and again *the* to the representation, which can then be passed on to the articulation procedures (stage 4).

The reason why we presented the workings of IPG in this respect in some detail, is that this view on the different status of content words and function words in production gives rise to a very specific prediction about the temporal structure of the production of utterances in languages like Dutch and English (for which IPG was designed), in which most function words *precede* the lexical heads of phrases. As we explained earlier, an empirical argument for the incremental nature of production consists in the occurrence of pauses. However, the model not only predicts that pauses occur at all, but also *where* they should normally occur. In Dutch, English, and similar languages, pauses are *not* to be expected *between* a function word and the related content word, but only at the phrase boundaries. The reason is that because of the assumed order of stages 2 and 3, whenever a function word (output of stage 3) is present, the associated lexical head (output of stage 2) is necessarily present as well. If it were not, the relevant functorization procedures could not have been called, so when the output of stage 3 is ready to be articulated, all related material that was produced in stage 2 is equally available.

IPG does not seem to be committed to a particular prediction in this respect for functional elements that *follow* content words or for languages in which most function words occur to the right of a lexical head, since in such cases the linear order to be produced is parallel to the assumed order of formulation processes (stage 2 for heads, stage 3 for function words). The claims in this paper concern only (languages with) function words preceding lexical heads. In this situation the assumption about the limited capacity of working memory comes into play: since

information in working memory is released as soon as possible (cf. stage 4), and since lexical heads are available in working memory when function words are, it follows that when function words are produced and thus released from working memory the related lexical head should be uttered as well. Hence normally no pauses are to be expected after a function word, whereas they are expected to be quite normal before a function word.

This is a clear and straightforward empirical prediction, related directly to a central assumption of the IPG model as incorporating a specific view on the relation between grammatical structure and the lexicon, viz. one that is maximally structure building, with no direct link whatsoever between the grammatical structure and the conceptual content of utterances (cf. above). It is also a prediction that we believe to be highly problematic. In ordinary language production, as we will see, pauses immediately following function words are so frequent that they must be taken as a quite normal phenomenon, not an exception. The next section is devoted to a demonstration of this claim. Following this demonstration, we will try to sketch an alternative view, incorporating the idea that function words mark grammatical constructions, or schema's, as structured symbolic units that may be retrieved from long term memory, just as so-called content words are.

3. Pause patterns relative to function words

Some quantitative data

The previous section discussed what may be considered the 'received' view in psycholinguistics on the interaction between processing and grammar. Function words are essentially markers of structure. They enter the production process by means of functorization procedures which are activated as soon as the lexical head of the phrase marker is activated. Producing determiners, for example, depends on features of the activated lemma (its syntactic category, for instance), while the functorization procedure checks the conceptual structure for the presence of features in order to decide whether a definite or an indefinite article is to be produced. Therefore, function words have no independently represented correlate at the level of conceptual structure.

The empirical phenomenon to be analysed in this section consists of *pause patterns* relative to function words. We will show that during the (oral) production of routine business letters, text producers tend to pause predominantly *after function words*.

Data were collected by audio taping six Dutch lawyers in their offices while they were dictating routine daily correspondence, using a dictation machine. The data were naturalistic, i.e. all letters were actually sent to business associates or

clients. The statistical data to be reported in this section are based on 120 of such letters. Together, these letters contained about 23,000 words, and over 7,800 pauses. Dictating can be taken to be a way of producing written texts (Schilperoord 1996: 19–23; see also Schilperoord 2001). All tapes were transcribed verbatim, including all pauses, errors, restarts and the like. Dictation was chosen because it makes the job of detecting, locating and measuring pauses fairly easy. Moreover, because of the monologic situation we may assume that pauses will not occur for interactional reasons, so that they may in general be considered to reflect cognitive processes. We only considered ‘silent’ pauses, not so-called filled ones (e.g., *uh*...) to increase the validity of this assumption further, as there are suggestions in the literature that different sorts of filled pauses may have specific functions (cf. Clark 1996). It should be noted, though, that our conclusions do not depend in any way on how specific these pause patterns are for dictation.³ We tested *general* predictions about the relationship between language production and grammatical structure, using dictation as material, and using pauses between increments of production as evidence for the status of the segments involved.

There are two possible causes for a pause or hesitation to pop up in the normal stream of speech:⁴ it may occur, firstly, because the language producer has some difficulty, or at least needs some time, in working out the conceptual specifications of his message, or secondly, because matching a concept with a lexical item leads to some delay. In both cases, however, we may expect pauses – allegedly reflecting these cognitive activities – to occur before a function word, and not after it. In other words, lexically driven models predict pauses to respect the phrasal structure of the message. Another way of putting this would be that by their very nature lexically driven models of language production deny that there might be any cognitive reason for a pause to occur after a function word.

With this in mind, let us now have a look at the following transcript, taken from a dictation session of a Dutch lawyer, producing a routine judicial letter – see example (7).

- (7) (...)
- 1. *deel ik u mede dat de /*
inform I you that the
 - 2. *door /*
by
 - 3. *mij op de /*
me at the
 - 4. *zitting van /*
session of
 - 5. *DATUM bij /*
DATE at

6. *de NAAM overhandigde* /
the NAME delivered
7. *pleitnotities* /
oral petitions
(...)
“...I inform you that the oral petitions delivered at NAME at the session
of DATE...”

All numbered lines represent the increments by which this stretch of discourse came about. That is, slashes after each line indicate a pause of at least .3 seconds.⁵ As can be seen in lines 1 to 5, pauses occur right after a function word – determiners in 1 and 3, and prepositions in 2, 4 and 5.

Obviously, the pattern shown in (7) is not what is expected on account of lexically driven models of speech production. Phrasal boundaries are often violated indicating that at these locations there is ‘structure’ with no apparent content (a situation that is ruled out by lexically driven models). If indeed these pauses reflect conceptualization or lexicalization processes, then where do the function words originate from? For example, if the presence of the determiner in line 3 depends on the presence of the lexical head *zitting* (“session”), as lexically driven models have it, then how can *de* (“the”) have been produced already whereas *zitting* is still underway, or may not even have been retrieved from memory? Phrased differently, how can we account for the fact that an NP is already ‘there’, so to speak, whereas its lexical head is not?

To anticipate the conclusion, it is our conviction that data such as these force us to seriously consider the possibility, first, that functional elements such as articles might have an independent correlate at the level of conceptual structure, and second, that structured phrases, such as noun phrases, may be activated during language production as relatively underspecified templates, or ‘constructions’. That is, ‘bare’ phrasal units may very well result from *retrieval* processes, with a complete structural unit being accessed holistically, in a ‘Gestalt’-like manner, rather than from computational processes that build them out of elementary parts.

However, in order to substantiate such a (far reaching) claim, we have to show that we are in fact dealing with a regular pattern in language production. That is, we have to show that what we see in (7) is not exceptional. To this end, we will provide information concerning the proportions of pauses relative to function words, such as articles and conjunctions. In brief, the question is: are we dealing with a phenomenon that occurs frequently enough to be theoretically interesting?

For the proportional analysis, we used the data-base described above. Each transition between every pair of words in the 120 texts in the corpus was scored for the syntactic category of the word preceding the transition and the syntactic category of the word following the transition. A gross distinction was made between

function words, such as articles, prepositions, and conjunctions on the one hand, and content words such as nouns, adjectives, adverbs and verbs, on the other. In addition, transitions between words were scored for the presence or absence of a pause. This information allows us to analyse pause occurrences in strings such as those in (8). Each slash marks a potential pause location:

- (8) /a/garden/
 /an/English/garden/
 /in/an/English/garden/
 /in/the/garden/of/Monet/
 /that/I/visited/an/English/garden/

The following set of patterns was selected for statistical analysis:

- (9) 1. det – (adjective) – N
 2. prep – NP
 3. conj – subordinate clause

The category “det” in (9) included the definite (*de* and *het*) and indefinite (*een*) articles, not demonstratives occupying a pre-nominal position. The category “prep” includes all prepositions, and pronouns were included as members of “NP”. Finally, “conj” consisted of the words *dat* and *om* (i.e., the elements that can introduce complement clauses, such as finite and infinite clauses, respectively), and that are therefore often considered purely grammatical elements, devoid of meaning.

These strings allow for the following set of possible locations for pauses:

- (10) 1. a. pause – det *and/or:* b. det – pause – (adj.) – N
 2. a. pause – prep *and/or:* b. prep – pause – NP
 3. a. pause – conj *and/or:* b. conj – pause – clause

We first estimated pause proportions for each possible location with regard to these three kinds of function words. Then, in order to put these proportions into perspective, comparisons were made between the proportions of pauses preceding and those following function words (the a- and b-columns in (10)). In order to produce interpretable comparisons for the first two categories (det – N, prep – NP), all sentence-initial occurrences of these phrasal types were omitted as other analyses had revealed pauses occur at almost every sentence (or paragraph) transition (Schilperoord 1996). As such pauses presumably serve widely different cognitive purposes, including them in the data set would lead to an overestimation of pause proportions before function words. Both proportionate data and comparisons are summarized in Table 2.

The data show that 53% of all determiners produced were followed by a pause, whereas 39% were preceded by a pause; similarly, 25% of the prepositions and 59% of conjunctions were followed by pauses. What is particularly noteworthy is

Table 2. Proportions of pauses and comparisons for three opposite pairs of pause locations (P = pause occurrence)

string types	proportions	χ^2
det – P	.53	93.91*
P – det	.39	
prep – P	.25	14.24*
P – prep	.30	
conj – P	.59	25.89*
P – conj	.47	

* = significant with $P \leq p .05$

that the proportions of pauses after function words is quite high, *given the prediction that no pauses should occur at these locations*. In the case of determiners and conjunctions, these proportions even exceed the ones of pauses preceding these functional categories (but the situation is the reverse for prepositions).⁶ A chi-square analysis proved these differences to be significant. So, to conclude this section, pause occurrences after function words are a highly regular phenomenon; in fact, the post function word location even seems to be the favourite one in the case of determiners and conjunctions.

Constructions: The case of determiners

The empirical evidence presented in the previous section indicates that pauses predominantly occur after ‘meaningless’ function words such as determiners and conjunctions. Given the processing assumptions discussed in the first section, these data are difficult to account for by lexically driven models of speech production. This section will (briefly) introduce an alternative view on production, based on the notion of *constructions* (cf. Langacker 1990; Goldberg 1995; Jackendoff 1995, 1997, 2002; Kay & Fillmore 1999). The basic tenet of our proposal is that phrasal categories are involved in the process of production as underspecified constructions or schemas, which, being stored in long term memory, are on a par with words – i.e., they are all contained in the mental lexicon. Indeed, the relevant distinction between lexically driven models of speech production and a construction based view primarily concerns the relation between ‘lexicon’ and ‘grammar’, and the interplay between what is *stored* knowledge and what is *computed* ‘on the fly’. In order to avoid redundancy, lexically driven models tend to identify the grammatical component of the production system as computational, and to reduce it to the smallest possible set of rules required to account for the facts of language. Consequently, if a certain grammatical structure (say, that of a noun phrase) can be computed by some set of rules, then noun phrase templates cannot be part of the declarative mental lexicon.

Construction based models, on the other hand, allow for redundancy: the ‘rules’ themselves are viewed as ‘constructional idioms’ (Jackendoff 1995: 155; Jackendoff 2002: Chapter 6) that may vary as to their degree of phonological specifications. This means that the outcomes of a certain set of rules coexist freely together with the rules. Redundancy is built in, so to speak, rather than an exception. With regard to noun phrases, the maximally underspecified or basic construction for languages such as English or Dutch is (11):

(11) NP: [det + ... + N]

This construction has a number of elaborations, inheriting the features of the basic constructions, as shown in (12).

(12) NP: [*de/het/een* + ... + N]

A construction such as (12) thus consists of a fixed element (the determiner), a ‘slot’ for the obligatory element (usually the lexical head) and (in some cases) some optional slots (indicated by dots). In addition, some expressions that are licensed by (11) may be fully specified, constituting a ‘fixed’ or ‘prefabricated’ construction (cf. Erman & Warren 2000), as in (13).

(13) *een kop koffie* (“a cup of coffee”)
het toilet (“the bathroom”)⁷

The essential property of basic schemas/constructions and their elaborations is that they are lexical items, stored in long term memory, despite the fact that they can be computed by phrase structure rules.

Now, how do such constructions allow us to account for the kind of pause patterns observed? Our discussion of this issue will first be confined to noun phrase constructions – later on, we will discuss prepositions and conjunctions. First, look at the transcript example in (14).

(14) (...)
1. *de* /
 the
2. *omstandigheid* /
 circumstance
 (...)

Let us suppose that the pause after the determiner *de* indeed signals some cognitive activity, aimed either at specifying the concept to be expressed, or at retrieving a lexical item that serves to express an already activated conceptual structure [CIRCUMSTANCE]. Since according to lexically driven models, the production of the determiner is ruled out in both situations, we have to look for ways in which the

determiner nevertheless can be produced independently from its ultimate lexical head (the noun *omstandigheid*). How can this be accomplished?

Our proposal is that in the course of producing the noun phrase *de omstandigheid*, in fact two independent structures are activated: one ‘schematic’ construction [*de* + ... + N], and one lexical element (*omstandigheid*, ‘circumstance’), and for some reason a more or less brief delay may occur between the activation of the two elements. Possible reasons for a delay of activation can be taken to be of the standard type (see also the discussion in Note 4); they may involve conceptualization (deciding on exactly what concept is to be expressed) or lexicalization (retrieving a lemma from the mental lexicon).

In a lexically driven model, there is just one possible alternative cause for a pause to occur in such a location. This has to do with the fact that a lexical entry is assumed to be split up into two parts: lemma and form information, where the former is used in the grammatical encoding stage of the Formulator, and the latter (specifying the word’s morphology and phonology, and ‘pointed’ to by the lemma) is in the phonological encoding phase. This makes it possible in principle that the following situation arises: the lemma (e.g., [CIRCUMSTANCE, *circumstance*, N, ...]) is retrieved, followed by grammatical processing and functorization leading to the utterance of an article (e.g. definite *the*), and then something goes wrong with retrieving the word’s phonological shape pointed to by the lemma. The resulting situation is one in which the speaker knows exactly what the word is he wants to say, with all kinds of relevant properties, except its full phonological shape; this is usually referred to as the *tip-of-the-tongue* phenomenon.

Thus, theoretically there is a way in an IPG-type model, to account for pauses following a function word, while maintaining that the model, including the production of function words, is lexically driven. The question is, however, to what extent this can be considered a serious alternative to the hypothesis that such pauses reflect genuine cognitive processes (conceptualization or lexical retrieval). First of all, as Levelt points out, little is known whether or not lexical retrieval is a one stage or two stage process – i.e., whether *in general* an entry’s lemma and form properties are retrieved simultaneously or successively: “The distinction should not be overstated. In particular, we should not conclude that a lexical entry cannot be retrieved as whole [...]” (Levelt 1989: 188). Secondly, as we all know from experience, the tip-of-the-tongue phenomenon is quite rare. If it were to account for the amount of observed pauses after determiners, we would be forced to assume this phenomenon to have occurred in over 50% of all noun phrases produced. This seems highly implausible. The safest thing to assume is therefore that the proportions presented in Table 2 are in fact marginally over-estimated. The large majority of cases, however, must have been produced by ordinary cognitive processes. We therefore feel justified in taking these data as strong support for our construction based proposal.

This account for (most of) the observed pause patterns immediately raises the question: What conceptual specification is required in order to activate the construction [*de* + ... + N] (cf. Section 1)? In other words, if indeed [*de* + ... + N] is a lexical item, what does it ‘mean’? Actually, we think an answer is readily available. From a conceptual point of view, a determiner such as *de* (“the”) indicates that an instance of the category named by the noun with which it combines is part of the body of knowledge that is shared in the communicative situation. The communicative situation is called the ‘ground’ of a linguistic usage event, and determiners (among other elements) in English, Dutch, and other languages are said to have the function of specifying if and how concepts are instantiated in the ground – i.e., of ‘grounding’ the concepts that they are applied to. In Langacker’s words:

In the case of (...) nominals, grounding is effected by articles, demonstratives and certain quantifiers. Whereas a simple noun (...) merely names a ‘type’ of thing, a full nominal (...) designates an ‘instance’ of that type (...). (Langacker 1990:321)

Langacker goes on by stating that “only ‘grammaticalized’ (as opposed to ‘lexical’) elements can serve as true grounding predications” (1990:322). Since speakers usually talk about ‘instances’ of things, rather than ‘types’, grounding is a necessary element of any speech act. So, to answer the question “What does a determiner mean?” we may say that it “means” [GROUNDED ENTITY], a conceptual structure that, as such, is associated with the construction [*de* + ... + N] in Dutch. Therefore, the notion of grounding constitutes the necessary conceptual motivation for determiners to pop up in the stream of language being produced. In addition however, it accounts for their appearance *independently* from the conceptual ‘type’ designated by the noun, and it is this property that we need in order to account for pauses occurring after function words. If the two lexical elements can be activated independently, rather than the activation of one being dependent on the activation of another, then nothing prohibits a ‘cognitive’ pause intervening between them.

If Langacker’s grounding theory is essentially adequate, the meaning of this schema (or construction) and its activation can be usefully phrased in terms of Jackendoff’s triple-theory of lexical items.⁸ The determiner represents a *grounding function*, taking an entity type as its argument, together constituting a [GROUNDED ENTITY]. This conceptual function can be represented as in (15):

$$(15) \quad [_{\text{entity}} \text{GROUND} [_{\text{entity type}} ()]]$$

Let us further assume that the Conceptual Structure is associated with Syntactic and Phonological Structures (CS, SS and PS, respectively) in the full lexical entry, as represented in (16). The associations are indicated by subscripts a, b, and c:

$$(16) \quad \begin{aligned} \text{CS: } & [_{\text{entity}} \text{GROUND}_a [_{\text{entity type}} ()]_b]_c \\ \text{SS: } & [_{\text{NP}} [_{\text{det}} \text{de}]_a N_b]_c \\ \text{PS: } & [[_{\text{CL}} \{de\}]_a [_{\text{WORD}} \{ \}]_b]_c \end{aligned}$$

According to this conception, a noun phrase, such as “the circumstance”, comes about as a result of a process of ‘unerging’⁹ of independently retrieved lexical items: (16), and the one shown in (17).

- (17) CS: [entity CIRCUMSTANCE]_x
 SS: [N]_x
 PS: [WORD {*circumstance*}]_x

The information in (17) tells us what type of entity is grounded; where it is to be inserted within the noun construction; and how it is to be pronounced.

To summarize our proposal, the production process underlying noun phrases such as the one in (14) consists of retrieving two independent structures: (16) and (17), respectively. As the retrieval of these structures may well be separated in time, this allows a pause to occur after a determiner as a result of either a process of working out the conceptual specifications of the ENTITY, or of a lexical search.

This assumption of two independently retrieved structures, as an assumption about language processing, is directly tied up with assumptions about the structure of a person’s linguistic knowledge. First, the cognitive status of determiners is not inherently different from that of lexical nouns, whereas IPG considers the former as output of a computational process and only the second as retrieved from memory. Second, there can be immediate connections between aspects of conceptual structure and determiners; the latter are essentially meaningful. In brief: as far as determiners and nouns are concerned, there is no essential difference between grammar and lexicon, and structure may be retrieved from memory on the basis of conceptual content.¹⁰ This is not to say that this is the only possible route for the production of noun phrases; we would rather see this as an entirely empirical issue, not precluding the possibility that similar products (linguistic utterances) may in actuality result from multiple and variably used cognitive resources. In the present context, however, the crucial point is that the idea of grammatical schema’s (partly specified by determiners) finds strong support in processing phenomena, viz. pauses in language production.

4. Infinitival conjunctions and prepositions

We will now turn to two other types of function words, in order to see whether the ideas put forth in the previous section may be generalized. This section is split up into two parts: the production of a special type of conjunction in Dutch, the infinitival conjunction *om*, after which attention will be paid to the functional category of prepositions.

Om-clauses

The sentences in (18) both contain a non-finite clause introduced by the (infinitival) conjunction *om* (“(for) to”, “in order to”).

- (18) a. *Ik moge u dan ook thans verzoeken om deze notas met de
I may you therefore now request for these invoices with the
grootste spoed aan de dienst over te leggen.*
utmost speed to the service over to put
“I therefore want to ask you now to hand these invoices over to the
department with the utmost speed.”
- b. *Misschien is het goed wanneer u een dezer dagen
Maybe is it good when you one these-GEN days
telefonisch contact met mij opneemt om hiervover nader te
telephone-ADJ contact with me takes-up for here-about further to
overleggen*
consult
“It may be a good idea that you call me one of these days in order to
discuss the matter further.”

The examples given here illustrate the most common uses of *om*-clauses in Dutch. (a) contains a complement clause *om ... over te leggen*, while (b) contains an adjunct *om .. te overleggen*. The ‘canonical’ grammatical construction of *om*-clauses can be captured as follows:

- (19) [*om* + ... + *te* + V_{inf}]

Conceptually speaking, however, there are some important differences between the two types of clauses. As we will show later in this section, there is a generalization to be made concerning the function of *om* itself in these two types (*om* is not homophonous), as well as the way in which they relate to their matrix clauses which is also quite different, and relevant to processing. In the case of a complement *om*-clause, the contents of the clause specify some aspects of the matrix phrase it is attached to, usually a mental space predicate (noun or verb of cognition or communication, e.g. *believe to*, *request to*, *promise to*), sometimes a causal predicate (e.g. *cause to*, *attempt to*). Adjuncts, on the other hand, are connected to the main clause by means of an adverbial relationship which is not itself predicated in the main clause, e.g. means-ends. Thus in (a), the *om*-clause specifies the object of the verb *verzoeken* (i.e., it gives the content of the request), whereas in (b), the relation of the *om*-clause to the main clause is interpreted such that its contents (“discussing the matter further”) constitutes the goal of “getting in touch with me”, which is expressed by the matrix clause. Thus the relationship between a non-finite complement clause and its matrix is that of part-to-whole (conceptually, as well as

syntactically) – i.e., a matter of constituency: the relationship between a matrix and an adjunct is that of two parts constituting a whole: it is a coherence relation creating a discourse unit.

Structural differences between both types of *om*-clauses testify to this conceptual difference. First, in the case of complements, *om* may be omitted (under certain conditions, cf. Van Haaften 1991). It is, in other words, optional for many of these clauses; but in adjuncts, such as in (b), *om* may never be omitted. Another difference concerns the order of clauses. In the case of adjuncts, the *om*-clause may be put in front position, a possibility that is ruled out for *om*-complements.

With this in mind, we may say that the construction is associated with two conceptualizations, as indicated in brackets, {...} revealing the optional nature of the enclosed element (either *om* or the entire clause); ‘→’ indicates a constituency relation and ‘↔’ indicates a coherence relation).¹¹

- (20) a. CS: [WHOLE_a →_x [PART]_b]_c
 SS: [matrix phrase_a + [{*om*]_x + ... + *te* + V_{inf}]_b]_c
 b. CS: [MEANS]_a ↔_x {[END]}_b
 SS: [[matrix phrase_a] + [{*om*]_x + ... + *te* + V_{inf}]_b]

As can be gleaned from (20), there is yet another difference in characterizing these two kinds of *om*-clauses. This feature is treated in detail in Schilperoord and Verhagen (1998) under the heading of *conceptual dependency*. Put briefly, *om*-complements represent some obligatory element of the matrix phrase. We can only conceptualize the event referred to by the verb *verzoeken* (“request”) if we can in one way or another construe the contents of what is being requested. On the other hand, the optionality of *om*-adjuncts reflects the fact that a sentence describing a certain action is in itself *not necessarily* interpreted as an instrument for reaching a goal in an event or state described in another clause. Put simply: one cannot make requests without some content, whereas one can get in touch with someone without this having to be thought of as an instrument for reaching some goal. This distinction leads us to the idea that the relation between a matrix phrase and an *om*-complement is to be located on the level of *clause structure*, whereas the relation between the matrix clause and an *om*-adjunct is to be located at the level of *discourse structure* (cf. Verhagen 2001 for a discussion of finite complementation as opposed to adjunction in these terms). In other words, *om* in *om*-adjuncts signals a *coherence relation* holding between two discourse segments (cf. Sanders, Spooren, & Noordman 1992).

Having discussed the two constructions *om* participates in, the question now is: What does the X in both CSs mean? In other words: What concept motivates the occurrence of *om* in both constructions? In principle one could assume that, since there are two constructions, there are two *oms* as well. However, that would miss an interesting generalization. As we said, in the case of adjuncts *om* marks

the relation between the matrix and the adjunct as one of means to ends; the fact that *om* specifically introduces the purpose clause is no coincidence: this clause represents the proposition that is not (yet) realized. It turns out that in this way, a generalization can be made to the role of *om* in complement clauses. Although the issue has been, and still is, much debated (cf. Pardoën 1998:419ff. and the references cited there), most analysts agree that *om* in complements also indicates a notion of ‘potentiality’. The role of *om*, as marking a purpose in the case of adjuncts, provides a specific instance of this concept; after all, a goal is a potential state of affairs that is yet to be realized. In complements too, the notions of ‘goal’ and ‘potentiality’ can be quite close. In (21), for example, the complement (“to never read anything by Voskuil again”) may be said to just express something potential that is not necessarily someone’s purpose, but in (22) the realization of the potential state of affairs (“to come home early”) is probably also the purpose of the person asking the question:

- (21) *Dit deed mij besluiten (om) nooit meer iets van Voskuil te lezen.*
 “This made me decide to never read anything by Voskuil again.”
- (22) *Hij vroeg mij (om) vroeg thuis te komen.*
 “He asked me to come home early.”

The possibility of *om* in these examples contrasts with (23):

- (23) *Hij beweert (*om) ziek te zijn.*
 “He claims to be ill.”

In such cases, *om* is prohibited. The explanation is precisely that *om* marks its complement as a potential, non-realized state of affairs, which conflicts in this case with the meaning of *claim*, imposing an interpretation as ‘real’ on its complement.

To conclude this point, the meaning of *om* can be captured as construing the potentiality of the state of affairs represented in the complement clause. Thus as far as its conceptual import is concerned, there is only one *om*. However, it is also part of the Dutch speaker’s linguistic knowledge that this element can conventionally participate in (at least) two different types of conceptual *relations*: one a part-whole relationship (complementation); and the other a relationship between two parts (coherence).

This provides us with a basis for believing that the presence of *om* is tightly related to the conceptual structure underlying its production, and not the result of the presence of the lexical head of the non-finite clause, as lexically driven models would have it. With regard to the distribution of pauses with respect to *om*-clauses that inherit the properties of the schemas in (20a) and (20b) respectively, IPG would predict no differences: pauses would occur mainly before *om*, but no differences as to pause frequencies are to be expected. Our construction based approach,

however, predicts a substantial amount of pauses, possibly even the majority, to occur *after* the production of *om*.

However, the differences between the schemas in (a) and (b) even allow for a further refinement of this prediction, especially with regard to pauses occurring before *om*. To see why, consider again the notion of conceptual dependency. In Schilperoord and Verhagen (1998), Langacker's definition of conceptual dependency was used:

D is conceptually dependent on A to the extent that A elaborates a salient substructure of D. (Langacker 1991:436)

Note that this definition only characterizes schema (20a), but not (20b). In (20a), the 'WHOLE'-concept is conceptually dependent upon the 'PART'-concept; that is, upon the non-finite complement clause, because the latter elaborates a salient, in fact an essential substructure of the 'WHOLE'-concept. The main clause in (20b) and its corresponding conceptual import is, however, *not* conceptually dependent upon the adjunct clause. Its contents may be conceptualized independently from the contents of the non-finite clause. And since pausing between discourse segments is a fairly regular phenomenon (Schilperoord 1996), our specific expectation is that the proportion of pauses before *om*-adjuncts will surpass the proportion of pauses before *om*-complements. Hence, the predictions are:

- I. Pause proportions after *om* \geq Pause proportions before *om*
- II. Pause proportions before *om*-adjuncts \geq Pause proportions before *om*-complements

In order to test this hypothesis, all cases of *om*-clauses within the corpus were selected, and labelled for their conceptual import (that is, whether it represented an instance of either (20a) (whole-part) or (20b) (means-end)). All cases of *om*-adjuncts in sentence initial position were excluded from the data base, for reasons mentioned earlier (see the discussion preceding Table 2). This resulted in 89 *om*-complements and 32 *om*-adjuncts. In addition, pauses occurring either before or after *om* were counted, and proportions were calculated, the results of which are presented in Table 3.

Table 3. Numbers and proportions (between brackets) of pauses before and after *om* in complements and adjuncts

		before <i>om</i>	after <i>om</i>
complements	(N = 89)	28 (.29)	68 (.71)
adjuncts	(N = 32)	21 (.46)	25 (.54)
Totals	(N = 121)	49 (.35)	93 (.65)

In accordance with our first prediction, the total number of pauses after *om* by far exceeds the number of pauses before *om* ($\chi^2(1) = 13.63, p < .001$). However, this is true only for complements ($\chi^2(1) = 16.67, p < .001$), but not for adjuncts ($\chi^2(1) < 1$). The second prediction concerned the (relative) number of pauses before *om* in case of *om*-complements and *om*-adjuncts. A chi-square test revealed that the proportion of pauses before *om*-adjuncts exceeds the one before *om*-complements ($\chi^2(1) = 3.85, p = .05$).¹² These data seem to indicate that in the production of *om*-complements the usual pause pattern is *om* -{pause}- *non-finite clause*, while the pattern characterizing the production of *om*-adjuncts is {pause}-*om* -{pause}-*non-finite clause*. Note that this marked difference between both instances of *om*-clauses could in no way have been predicted on account of lexically driven models, since according to such models, the different conceptual structures in which *om*-clauses occur are not allowed to play any role as far as producing the ‘functional’ category *om* is concerned; *om* would enter the picture as the result of a functorization procedure, triggered by the clausal head alone (the V, being non-finite). In other words, lexically driven models would have predicted *no* proportionate differences with respect to the two types of *om*-clauses. However, as the schema’s in (20) clearly show, it is not the verb of the non-finite clause that makes the difference between the two kinds of *om*-clauses.

We have now shown that, just as for determiners, a conceptual motivation for the presence of the conjunction *om* can be provided. *Om* marks the potentiality of the proposition expressed by its complement. We also showed that *om* participates in different constructions, in such a way that processing differences can be deduced depending on the kind of construction, and that these differences actually show up in systematically different patterns of pauses for these constructions.

Prepositions

We have now discussed two types of function words with different kinds of functions. In the sub-section *Constructions*, we analysed determiners as providing ‘grounding’ information for (roughly) ‘things’ under discussion in a discourse and as activating a noun phrase schema; and in the sub-section *Om-clauses*, we characterized the element *om* as activating a non-finite clause schema and marking the proposition as potential, either as a part of a complementation schema or as a marker of a coherence relation – a difference that was clearly reflected in the pause data. In the course of the discussion, it also became evident that pause patterns around function words may actually differ significantly depending on ‘details’ of the *precise* conceptual and linguistic relationship between a specific function word and its environment. To conclude our discussion of the relationship between linguistic knowledge and linguistic processing, we will now turn to prepositions.

The implicit claim of a language production model such as IPG, making a categorical distinction between content words (independent entries in the mental lexicon) and function words, is that elements of each of the two classes share some crucial properties that are not shared with elements from the other class (cf. Slobin 2001 for a critical discussion from the point of view of acquisition). We have already put forward several arguments against such a claim, but prepositions provide a particularly strong case against it.

That prepositions pose a challenge for such a view could actually have been clear from the very beginning of IPG. Prepositions are markers of some kind of relation. Sometimes those relations seem to be purely 'grammatical'; in a construct like *the transfer of the documents to the judge by the lawyer*, the prepositions *of*, *to*, and *by* apparently just mark the grammatical relations in the nominal phrase (direct and indirect object, and subject, respectively); whereas in something like *staying under water during a whole day* the prepositions *under* and *during* express conceptual content. On the basis of this observation, Kempen and Hoenkamp (1987) divided the class of prepositions into two types: 'short' and 'frequent' prepositions on the one hand; 'long', 'infrequent' ones on the other. Short prepositions, such as *of*, *to*, *in*, *by*, are believed to serve grammatical functions,¹³ and therefore belong to the class of function words, which are supposed to be produced through the application of functorization procedures, as we have seen. Longer and less frequent prepositions (*beneath*, *during*, *despite*, etc.) are assigned to the class of content words expressing conceptual content, and thus are produced by means of lexicalization, in the IPG-model.

In view of the preceding discussion we may conclude that this version of IPG predicts systematic differences in the distribution of pauses around prepositions. No pauses are to be expected after the short, grammatical prepositions, precisely because they result from functorization which follows lexicalization; but pauses might very well occur after the longer, lexical prepositions. However, in transcript (7), pauses can occur right after the short prepositions *door* ("by"), *van* ("of"), and *bij* ("at"), and we have little reason to believe that this would be unnatural or uncommon. So as far as we can see, the proposed division of the class of prepositions into grammatical and lexical subclasses lacks empirical support.

However, prepositions as a class might still be said to occupy a kind of intermediate position, but in a different sense. Our view on the cognitive status of function words as developed in the previous sections implies that we attribute two distinct characteristics to them: one is their conceptual import (e.g. marking grounding, or potentiality); the other the fact that they activate a particular linguistic schema, a grammatical construction of some kind. Especially in the class of prepositions, the precise 'balance' between these features can differ greatly: whereas some elements serve more as schema activators than as indications of some specific conceptual content, others may specify the conceptual content of part of a message in a highly

particular way. In the former kind of cases, the ‘meaning’ of the element in question may be felt to be so vague as to be virtually absent, which may lead people to conclude it serves ‘only’ a grammatical function. In our view, however, this represents just one extreme end of a *scale* of differences between the relative weights of conceptual content and schema activation, the other extreme end being the case of names – i.e., elements evoking a certain conceptual constellation but not activating any particular linguistic schema. On this scale, prepositions can occupy a wide range of positions, but there is no sharp dividing line between one class of (purely) grammatical elements, and another of (purely) lexical ones.

This approach also provides a basis for understanding the difference in pause patterns between prepositions and other function words in Table 2: there are more pauses *before* prepositions than after them, whereas it is the other way around in the case of determiners and conjunctions. This may very well be a statistical result of the fact that many prepositions have at least some specific conceptual content, so that the production of a preposition more often reflects a conceptual choice which may require some time than the choice of, for instance, a determiner, where the function of schema activation is relatively more important.

On the other hand, prepositions, especially if their meaning is highly schematic as in cases such as *of*, can participate in different grammatical schema’s, and thus give rise to different pause patterns in production. An illustration of this phenomenon was provided in the previous section. There are fewer pauses before *om* when it is part of a complementation construction than when it introduces an adjunct. Thus we actually should not expect any direct relationship between a particular *word* and the distribution of pauses during the production of this word; rather what we should look at is the construction of which it is a part on a specific occasion of use. In the case of prepositions, a phenomenon that is especially relevant is that of the so-called ‘fixed prepositions’ (as in prepositional objects, but also in other kinds of expressions). Consider expressions of the type “reply to X”, “think of X”, “talk about X”, and the like. In a view of linguistic knowledge as consisting largely of schema’s that may occur in any degree of abstractness, these expressions are no more than simple illustrations of the point; the schema’s may be retrieved from memory in their entirety. But in a view that distinguishes sharply between lexicalization and functorization, these expressions are much more problematic. Kempen and Hoenkamp (1987) implicitly treat *listen to* as a single lexical item, but they do not elaborate the point generally. One important point is, in our view, the fact that such units are still analysable.¹⁴ That is, *think* in the combination *think of* still means THINK, and *of* functions as an introduction of a PP-complement, in the same way as it does in *the start of the program*. It is not clear at all how an approach with a strict separation of lexicon and grammar would allow for this. Another point is that there are many cases where the choice of a head noun or verb (such as *think* or *reply*) may strongly constrain the choice of preposition, but

does not determine it fully (consider *think of* and *think about*, for example); again, in a ‘maximalistic’ schema conception, this does not pose a problem, but it is not at all clear how this could be accounted for with a strict separation of lexicalization and functorization.

Thus, the strict division of prepositions into two subclasses with completely different processing properties, as proposed by Kempen and Hoenkamp (1987), does not seem viable. In retrospect, this should perhaps not come as a surprise. After all, the fact that they are all called prepositions is based on similarities in linguistic behaviour, which becomes something of a riddle when some prepositions are assigned a fundamentally different linguistic and cognitive status than others. Furthermore, the whole idea that superficial properties such as length and frequency of prepositions would correlate *directly* with a specific kind of cognitive status, seems highly implausible, both from a language-internal and from a comparative perspective. For example, would *in* and *into* in English have to be produced by two crucially different components of the Formulator – i.e., as a result of functorization and lexicalization, respectively? Or, would the same be true for *na* (“after”) in Dutch and *after* in English? Positive answers to both types of questions seem unlikely a priori, so that they would require substantive empirical and theoretical support. But they are precisely what IPG suggests, though without much independent support.

All in all, it seems to us that when considered carefully, the treatment of prepositions in a lexically driven model gives rise to exactly the kind of problems that show that the distinction between lexicalization and functorization as processes that are supposed to be temporally separated in a systematic way, is untenable.

5. Conclusion

What we have presented in this paper represents, as usual, to a large extent work in progress. We nevertheless believe to have established some points of general interest. Our explicit aim was to bring together cognitive linguistic views on the nature of linguistic knowledge on the one hand, and evidence from actual language processing on the other. In this way, we have been able to propose some reasonable theoretical accounts for empirical observations of language-in-use (viz. pause patterns relative to function words). Admittedly, some of the ideas presented are still somewhat vague, and as such they may seem to lack the formal elegance and rigour that constitute much of the attractiveness of models such as IPG, positing a strict division of labour between declarative and procedural components of linguistic knowledge (‘lexicon’ as opposed to ‘grammar’; ‘content words’ as opposed to ‘function words’). But elegance and rigour are not all that matters, of course, and especially not if such models leave data obtained from actual language use un-

explained. Despite some vagueness, we therefore claim to have demonstrated the following points.

1. The production of linguistic elements marking grammatical constructions (so-called function words) does not have to depend on specification of other linguistic elements, assumed to express the conceptual content of a message (so-called content words, or lexical entries); conceptual motivation can be provided for the production of alleged function words independently from their 'lexical heads' or neighbours.
2. Therefore, linguistic knowledge, as put to use in spontaneous processes of language production, does not involve a principled distinction between 'functional' and 'lexical' words.
3. The view of language production that emerges from this is that of a person assembling an utterance by putting together a number of symbolic units retrieved from long term memory, some of which are more schematic than others, and each of which is relevant to at least some aspect of the message to be conveyed; constraints on the way the units are put together derive from information in the units themselves, at least to a large extent.

By themselves, these ideas are not new, as even a brief glance at the history of cognitive linguistics shows. However, showing that one can use data from spontaneous language use to support these ideas is relatively new. Although it may sometimes be convenient, for expository purposes, to make a distinction between the linguistic system and language use, we would like to stress the importance of combining these points of view in linguistic research if we want to avoid either developing empirically inadequate theories or collecting theoretically empty data.

As a final theoretical point, we would like to explicate one general consequence of these ideas. We think our results actually call for a serious reconsideration of the role of abstract notions such as 'function word', and abstract categories such as 'Noun', 'Verb', or 'Preposition' in theories of linguistic processing, and consequently in actual linguistic knowledge. Models such as IPG are obviously strongly inspired by formal theories of grammar, and therefore take great pains to model the role of abstract grammatical categories independently from concrete semantic and phonetic considerations. Levelt's (1989) Formulator thus models the lexico-grammatical stage of the production process as a computational process of manipulating abstract, formal categories. Meaning is strictly separated from grammar, with a lexicon as mediator, and at the other side phonetic properties of an utterance are also separated from the grammar. Grammatical operations are *not* conceived as operations on units of meaning and form – i.e., symbolic elements. But does an abstract, formally defined notion of 'function word' ever play a separate role in processing, independently from the conceptual characterization of the specific element involved? IPG, formally inspired as it is, in fact embodies

the claim that this abstract notion has *direct* relevance in processing; similarly, it implies that equally abstract notions such as NP and PP, defining functorization procedures that essentially mirror very general phrase structure rules, have direct processing relevance. Our results, however, suggests a rather different picture.

As we have seen, there are statistical patterns in the distribution of pauses around function words that do indeed tell us something about their cognitive status. But it has been clear from the start, first of all, that these patterns do not set function words apart, and second, that they are not the same for all subtypes of function words: prepositions differ significantly from determiners and conjunctions. Thus the notion “function word” does not really seem to have a unitary status in processing. Subsequently, we found that the more specific notion “infinitival conjunction” does not have some unitary processing relevance either: the way *om* is produced in complementation constructions differs from its production process in adjuncts. We also argued that we should in fact not expect specific prepositions to have exactly the same kind of processing properties as other ones. In IPG, prepositions are divided into two subclasses with different processing properties – i.e., a lexical and a grammatical one, in an apparent attempt to retain the idea of immediate processing relevance of such abstract notions. But the more details of actual language processing are taken into account, the more it becomes evident that ultimately each element has its own set of processing properties (which may vary with the constructions in which it participates). Some elements will be more similar in their processing properties than others; these relations of higher and lower degrees of similarity may provide a partial organization (in a kind of network) of the elements, and some of the nodes in this network may correspond to categories such as “Noun” or “Preposition”, which are essentially no more than sets of elements of, to some degree, similar linguistic behaviour, but without such an abstract notion in itself ever being directly relevant in processing.¹⁵ In fact, as we have seen, the best way to conceive of the activation of a grammatical schema, e.g. the “NP-schema”, is as the result of the activation of a function word – e.g., a determiner, the selection of which is itself directly motivated by some aspect of conceptual structure. What we process in linguistic communication are conceptual categories and relations which are conventionally associated with particular patterns of form; many of these categories and the relations between them are ‘frozen’ to varying degrees, into what may be analysed as ‘constructions’. These specific constructions are what we use when we produce language.

Notes

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1. The superscript indicates the number of levels of a category in the sense of the X-bar notation (“N²” = “N-double bar”).
2. Kempen and Hoenkamp’s notation of syntactic structures differs from standard generative tree structures in that they explicitly specify at least some of the grammatical functions. This functional information, even though it may strictly speaking be redundant, must be represented in the structure at some point anyhow in order to function as a trigger for the relevant functorization procedures, in this case for example the ones that ultimately result in the insertion of the preposition *of*.
3. This question was raised by one of the reviewers of this paper. Although we are not aware of research into the distribution of pauses with respect to function words in spontaneous conversation, incidental observations, including some reported in the literature (e.g., Clark 1996:268) do suggest that similar patterns at least occur in conversation as well. See Schilperoord (2001) for various methodological and empirical aspects of dictation research.
4. Of course, pauses may have various other sources than cognitive ones, and this may endanger the validity of both our data and the conclusions drawn from them. In our research, we consider a pause ‘cognitive’ if it reflects conceptualization processes or lexical retrieval (see Boomer 1965; Schilperoord 1996). But what about other sources of pausing, how can we be sure to have kept pauses from other sources out of the corpus? We should first distinguish between pauses that are involuntary, and pauses that language producers willingly insert into the stream of speech. These latter pauses occur by intent and often serve rhetorical or communicative purposes, i.e. they are oriented towards an addressee. Clearly, such pauses could not be considered cognitive in the above sense. However, the possibility of such pauses being present in our corpus can safely be ruled out because of the strictly monologic nature of the production circumstances. All letters in our corpus were dictated to a machine, not to secretaries taking notes. Hence, pauses cannot even have resulted from a friendly employer pausing for the typist’s convenience. But even if pauses can be considered involuntary, they still can be caused by various factors. In terms of the IPG-model, pauses may be caused by all main components of the model, and therefore they may reflect conceptualization processes (preparing what to say), lexical-grammatical processes (retrieving lexical items), morpho-phonological processes (accessing word forms), monitoring processes (monitoring one’s own production), or they may originate from the workings of the articulator. Let us briefly consider these factors in turn. Obviously, the first two factors do not pose any problem since these are the factors that we are interested in in the first place. Pauses caused by the *articulator* were excluded from the corpus on grounds of pause duration. Dechert and Raupauch (1980) have calculated that ‘breathing’ pauses last .3 seconds at most, so we simply excluded pauses up to that length from the corpus. One should keep in mind that pauses lasting longer than .3 seconds may reflect articular activity, but in those cases one can be sure that this is not the *only* factor causing these pauses. In other words, pauses lasting over .3 seconds at least *also* originate from cognitive processing (see also Note 5).

Then there may be *morpho-phonological* factors causing pauses manifesting the so-called *tip-of-the-tongue*. Clearly, such pauses are not cognitive. However, as we devote a lengthy discussion to this possibility in Section 3 (p. 14), we leave this issue aside here.

In addition, pauses may originate from the workings of the *monitor*. While producing texts, text producers constantly monitor their own production. They attend to various aspects of their actions, such as content, choices of phrasing, and so on. Monitoring becomes apparent from various types of self-repairs that are produced ‘on the fly’, that is, while producing speech, but the monitoring process may also cause pauses itself. Once again, monitoring pauses are not the type of pauses that we are interested in here, so how can we be sure that monitoring does not interfere with conceptualization and lexical retrieval? To be honest, we cannot in any strict sense. However, there is some circumstantial evidence that in dictation, monitoring predominantly occurs at pre-established locations: major text structural locations such as prior to paragraphs and sentences. While it is clear that in spontaneous speech, the orientation of monitoring is mainly backwards, under the far more controlled production circumstances that we are dealing with here, its orientation is mainly forwards. That is, while dictating letters, text producers devote quite some attention to conceptual planning pieces of text *in advance*. One factor suggesting this is the fact that in dictation self-repairs are almost totally absent. Another point is the fact that pausing between paragraphs or sentences last considerably longer than pausing within sentences and clauses (see Schilperoord 1996, 2001), suggesting that at these locations preplanning the content of text parts takes place. Since the pauses that we are interested in are all located around function words, there seem to be good reasons for assuming that such pauses reflect the processes of refining conceptualization or retrieving lexical items.

To conclude, our considerations thus far suggest the pauses in our corpus to be mainly caused by cognitive factors (conceptualization, lexical retrieval). Admittedly, other factors can never be ruled out completely, but in the absence of any compelling evidence that such factors correlate structurally with the relevant location types that we consider in this chapter, we may safely assume that these other factors are randomly distributed, and hence do not jeopardize the validity of the data. Finally, we would like to stress the fact that pausing in language production is an empirical phenomenon, and that pausing parameters, such as pause locations, can be analyzed independently from any pre-established theoretical point of view, be it computational psycholinguistics, or cognitive linguistics. What matters, in our view, is how to arrive at a proper account of this issue.

5. In psycholinguistics, .3 seconds is the generally accepted ‘cut off’ value for a pause to be taken as reflecting some cognitive activity, rather than as resulting from muscular activities of the vocal tract. See for example Dechert and Raupauch (1980).
6. This may have something to do with the somewhat ambivalent status of prepositions with regard to their category status: lexical or functional. See Section 4.2 for further discussion, and also Schilperoord (1996), Schilperoord and Verhagen (1997).
7. In case a reader wonders what is ‘fixed’ about these expressions, compare them with the phrases *this cup of coffee* and *a bathroom* (e.g. in *Would you like this cup of coffee?* or *Where can I find a bathroom, please?*).
8. In Jackendoff’s (2002) theory, lexical items are viewed as *correspondence rules* between semantic, syntactic and phonological information. Moreover, a lexical entry may be both larger and smaller than an individual word. Idioms are a case in point, but a plural suffix, as an item licensing the formation of plural forms, is also a lexical entry. These assumptions are shared by all present construction based approaches to grammar. Croft (2001) may be seen as arguing against a separate level SS for syntactic information, essentially because there is no way to define

the necessary global syntactic notions (“noun”, etc.) in a non-circular fashion, independently of (language) specific constructions. In his view, the information usually considered syntactic reduces to schematic aspects of form and to the symbolic relation *between* form and meaning. On the other hand, Croft’s view seems to allow for *language specific* distributional classes to be included in the specification of the form of a construction. As this issue is not directly relevant for the present discussion, we use the more conservative notation here. To avoid misunderstanding: we use Jackendoff’s formalism only for reasons of convenience. As he has repeatedly and rightly pointed out himself, the formalism does not assume any particular theoretical point of view.

9. This is the term used in Jackendoff (2002); another term used for essentially the same concept is ‘unification’. See Goldberg (1995), among others, for discussion of the way this notion fits into the theory of Construction Grammar.

10. While the possibility of a direct relationship between a function word and conceptual structure is a necessary condition for language production as we see it, a reviewer suggested that it might be a sufficient condition. For example, the production of a determiner such as *the* could be motivated by the presence of the feature +accessible in the conceptual structure, but it need not activate the structure “det–N”, which might still come from the head noun. Being lexically driven or not and being structure building or not are in principle separate characteristics of a production model. On logical grounds, such a possibility cannot be foreclosed, obviously. However, it is first of all not a part of IPG, and second, we have explicitly based our proposal on the constructional approach. The analyses of function words that we are aware of, all share the view that precisely what makes these elements “grammatical”, is the fact that they do not function independently (they are “bound forms”), and are necessarily associated with other, variable linguistic material. We thus continue to assume that activation of a function word by a feature of the conceptual structure also activates the associated schema.

11. For ease of exposition, we conflated the two formal representational levels S[yntactic] S[tructure] and P[honetic] S[tructure]. But see also Note 8.

12. The difference between the proportions of pauses after *om* failed to reach significance ($\chi^2(1) = 3.31, p > .10$).

13. Confusingly labelled ‘clitics’; they are not pronominal and they are also phonologically independent.

14. Recall that analyzability does not imply compositionality (in the sense of ‘having been composed’). If elements can be distinguished within a linguistic unit (analyzability), it does not follow that the unit has been constructed out of these elements. Even obvious idioms, necessarily stored as units, may exhibit analyzability: in *spill the beans*, the element *spill* corresponds to the semantic component divulge and *the beans* corresponds to information. For a recent discussion, moving in a somewhat different direction, cf. Croft (2001: 180–184).

15. This position resembles the one defended for linguistic theory in general on the basis of methodological, typological and analytic considerations in Croft (2001), and from the perspective of acquisition in Slobin (2001). In a sense, our analysis provides an additional argument from processing for the hypothesis that global structural notions do not really have explanatory power, and are not primitive but rather based on similarities between specific constructions (cf. Verhagen 2002: 420/421).

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