1. Introduction

It has been widely assumed that -ung-nominalisation in German is — to some extent — productive. But how productive is it? Which -ung-nouns can be regarded as the products of general principles and which can only be seen as idiosyncratic — remains, perhaps, of some earlier stage of the language? And what, most importantly, are the -ung-formation rules that are productive in German as it is spoken today, and how do they operate, and on what? Among -ung-nouns that suggest themselves as likely candidates for a systematic account in terms of general principles are those derived from prefix verbs with prefixes like be-, er-, ver-. It seems that such nouns can be formed freely; and new ones can be formed as soon as the corresponding verb has made it into the vocabulary. These nouns, one might say, cry out for an account in terms of productive rules. At the other extreme we find nouns like Böschung (embankment). It seems extremely unlikely that any general principles could account for the existence and meaning of a noun like this.

The problem that German -ung-nominalisation raises is not, however, just how to distinguish between 'productive' and 'non-productive' -ung-nouns and to provide rules for the former. The problem is also to explain why certain -ung-nouns are not possible: What is it about a verb that makes it unfit

---

*This paper grow out of joint work with the members of the projects B4 and D1 of the long-term research-project *Incremental Specification in Context*, funded by the *Deutsche Forschungsgemeinschaft*. We wish to thank Fritz Hamm, Uwe Reyle and other members of the SFB-372. The research of the paper is largely due to the first author.
for the basis of an -ung-noun? And finally there is the denotation problem: What kind of entities can -ung-nouns denote? What makes this last problem intriguing is that many -ung-nouns are denotationally ambiguous; there is more than one kind of entity they can denote. Moreover, different -ung-nouns are ambiguous in different ways. An example of an -ung-noun that is three ways ambiguous is Absperrung (from absperren, ‘cordon off’, ’make inaccessible by erecting a fence or barricade’). Absperrung can denote (i) the event of ‘cordonning off, etc.’, (ii) the state resulting from such an event, and (iii) the fence or barricade erected during the event and responsible for the state. Other -ung-nouns are only two-ways ambiguous: Messung (from messen, ’to measure’) can either denote the ’event of measuring’ or the recorded measurement value. Trennung (from trennen, ’separate’) can denote either separation events or the corresponding result states. Lastly, some -ung-nouns are univocal, (e.g. Bekämpfung (from bekämpfen, ’fight’), which can only denote fighting events. A theory of -ung-nominalisation should ideally be able to predict what denotations are possible for different -ung-nouns. That is, the rules which tell us when -ung-nominalisation is possible should tell us at the same time how the ‘input’ from which an -ung-noun can be derived determines what different readings it can have.

-Ung-nominalisation is usually thought of as an operation that derives nouns from verbs. To the extent that this is right, it entails that it is the verb that must tell us (a) whether an -ung-noun can be derived from it, and (b) what the noun can mean, given that one exists. Thus a satisfactory theory of -ung-nominalisation requires a suitable classification of verbs. But not only that; if the theory is to give us some explanation why -ung-nominalisation is possible for some verbs and not for others and why the resulting noun is sometimes unambiguous and sometimes ambiguous (and in which way), then it should classify verbs in terms of some kind of internal structure with which the -ung-nominalisation operator can interact in ways that yield the desired results (i.e. either no -ung-noun or one with the correct range of denotations). This then is the central focus of the present paper: to propose an account of internal verb-structure which is adequate to this task. The internal structures of verbs with which we will work are inspired by, and closely related to, proposals made within the DM (Distributed Morphology) literature, especially in the work of (Marantz 1997), (Marantz 2005). We should emphasise, however, that we do not see the proposals we make as standing or falling with the DM-program as a whole. As we understand that program, it wants to build
all well-formed linguistic structures, in particular sentences, from so-called roots. Roots can be used to build structures, traditionally called 'words', and, from these even larger units — phrases and clauses in the sense of traditional syntax. Furthermore, the system of formation principles that operates 'below the word level' is supposed to be the very same as that which operates 'above' it; and as a consequence the notion of a 'word' — and thus the concept of the lexicon of a language as it has been traditionally understood — loses its central significance for the theory of grammar. ¹ The proposals made here are, as far as we know, compatible with this program, and perhaps they can make a contribution to it. But even if the DM program would have to be abandoned because the principles of word formation cannot be made to coincide with those that govern the formation of phrases and clauses from words, that should not automatically carry with it the downfall of the proposal we will make. The proposal could still be retained as an account for the internal structure of certain types of words (verbs and deverbal nouns) and thereby for distributional and semantic properties of certain types of word formation, but perhaps as part of the theory of the lexicon in its traditional sense (and thus now as part of a lexicalist theory of grammar). One respect in which the account presented here differs from all existing work within the DM framework with which we are familiar is that it comes with a systematic formal semantics, which builds semantic representations compositionally from the internal structures we will propose. This component of the theory is essential to the predictions it makes about the possible readings of -ung-nouns. But more generally it conforms to the intention that, by and large, syntactic structure is the systematic key to meaning. (This aspect of the theory may also make it of interest to people outside the DM community).

The semantic formalism we will be using is DRT (rather than some version of the \(\lambda\)-calculus, such as Montague’s Higher Order Intensional Logic.) The choice of DRT is motivated by the general setting within which the present investigation was undertaken, that of developing a DRT-based lexicon, which provides semantic representations for lexical items that can be used in building semantic representations of sentences (and larger discourse units) in which these lexical items occur. For all we know, though, the use of DRT is not essential for the particular task that semantically interpreted word-structures are to serve here (that of accounting for the facts connected with -ung-nominalisation).

One of the most difficult decisions in an enterprise like this is which cases
to treat as idiosyncratic and thus as outside the scope of one’s general theory. At the still early stage of development of the theory that we present here it would be premature to make definitive commitments on that point. What we can and will offer in this paper is a set of principles that derive -ung-nouns from certain verb structures (and which explain why certain verb structures do not yield -ung-nouns.) Many existing -ung-nouns won’t be covered by these principles, but that should not be taken to mean that we consider them as beyond systematic treatment. This is one respect in which what is presented here is incomplete.\(^2\)

Since the field of -ung-nouns is mined with potential counterexamples to any principles one might want to come up with, it is recommendable to proceed though that field with caution and to start at an end that is comparatively safe. This is what has so far guided us in the explorations reported here, and it is also the way in which we will present the results, such as we have them at this point. Some motivation for proceeding along the path we have chosen will be given in section 2.3. The leading hypothesis about the question when -ung-nominalisation is possible is presented and defended in section 3. Section 4 is devoted to the semantics of -ung-nouns.

2. Which verbal constructions allow for ungenominalisation?

2.1. some positive cases

As stated in the introduction, the central and most difficult part of our task is to uncover the relevant internal structure of the different types of verbs. Let us start with a group of verbs that do permit the derivation of -ung-nominals. These are verbs built from roots that denote properties of individuals.\(^3\) We will refer to such roots as ‘property’ roots, or ‘adjectival’ roots. Among the verbs built from such verbs are the ones listed in (1).

\begin{equation}
\begin{align*}
\text{ändern} \ (\text{from ander, ‘other’}),
\text{bereiten} \ (\text{from bereit, ‘ready’}),
\text{klären} \ (\text{from klar, ‘clear’}),
\text{säubern} \ (\text{from sauber, ‘clean’}),
\text{schärfen} \ (\text{from scharf, ‘sharp’}),
\text{trocknen} \ (\text{from trocken, ‘dry’}),
\text{weiten} \ (\text{from weit ‘wide’}),
\end{align*}
\end{equation}

In addition to verbs like those in (1) there are many prefix and particle verbs with adjectival roots; some are given in (2). (That these verbs are built from
adjectival roots, and that these enter into some kind of 'direct' interaction with the particle is indicated by the fact that there are no corresponding 'stem verbs', e.g. there is no verb *hellen*, etc.\).

(2) *auffrischen* ('up'+frisch, 'to refresh'), *aufhellen* ('up'+hell, 'to lighten up'), *aufmuntern* ('up'+munter, 'to cheer up'); *ergrauen* ('er'+grau, 'to turn grey'), *verengen* ('ver'+eng, 'to narrow'), etc.

Not all verbs built from adjectival roots permit *-ung*-nominalisation, however. Examples of verbs that do not are *wachen* (be awake, be on the watch), *grün* (to flourish, lit. to be green), *erröten* (to blush). The reason is that although these verbs are also built from adjectival roots, they are built differently. The difference can be recognised when we attend more closely to the meanings of the two kinds of verbs. The verbs in (1) and (2) are change-of-state verbs, in which the adjectival root describes the result state. For the just mentioned verbs this is not so. These are state or activity verbs in which the adjectival root describes the state the subject is in or the activity it is engaged in while the state or activity goes on.\)

Another example that has been suggested to us (Bierwisch, p.c) as a counterexample to the claim that verbs built from adjectival roots allow for *-ung*-nominalisation is *sterben* (to die). There is no *-ung*-noun *Sterbung*; and that is so although *sterben* seems a paradigm example of a 'change-of-state'-verb — what more dramatic state change is there than that from life to death? Our reply to this is that *sterben* is not built from an adjectival root. (In this respect it differs from the transitive verb *töten*, which is built from the adjectival root *tot*, and for which there exists a corresponding noun *Tötung*.) Rather, we take it, the root of *sterben* is an eventive root and not a predicate describing the final state of the grammatical subject of the verb. This again is a point that cannot be proved just by looking at this one particular verb but that gains credibility when it is considered in the context of the present proposal in its entirety.\)

In fact, there is an important general moral with this example, of which we will encounter other examples as we proceed: what can be inferred about a verb from its semantics is not decisive for the questions we are after. (When are *-ung*-nouns possible and what can they mean?). As will become clear soon, the notion of 'change-of-state verb' that is relevant here is that of verb with a certain internal structure. In general, aspectual and argument-related classifications of verbs on the basis of their actual meaning and surface argument structure are insufficient or misleading for our purpose; it is this circumstance that makes an approach of the kind proposed here,
in which verbs and other words are assigned 'DM-inspired' structure, useful and, we believe, indispensible to a theory of -ung-nominalisation.

A second general type of verbs allowing -ung-nominalisation is illustrated by those in (3) — (5).

(3) be-mannen, (to establish a staff), be-lasten, (to burden, to load), be-noten, (to assign a grade), be-pflastern or pflastern, (to pave), be-stuhlen, (to furnish, fill with seats), (sich) kleiden, (to dress), mustern, (to imprint a pattern), würzen, (to spice),...

(4) bilden, (to constitute), (sich) formen, (to take shape), messen, (to measure), schätzen, (to estimate), werten (to estimate), zeichnen (to draw),...

(5) (sich) häufen (to accumulate), teilen (to divide), sammeln (to collect); würfeln (to cut to cubes),...

All these involve what may be called 'nominal’, or 'sortal’ roots. These are roots that denote 'sorts’ of entities and which contribute an entity of the denoted sort to the event complex denoted by the verb (in contrast to adjectival roots whose arguments are introduced elsewhere in the structure — more about this later, see section 3). The verbs in (3) all describe processes in which something of the sort described by the root is added to something else. Some of these verbs involve the prefix be- (which is morphologically related to the preposition bei (become (at, near)), but as the list shows, not all of them. In the verbs in (4) the root contributes a thing that is produced as part of the process that the verb describes. But note that here too the root contributes an entity rather than that it serves as a predicate for an entity that is established elsewhere. Werten for instance is 'to assign a Wert (value)' to whatever is the verb’s direct object. Sich formen is, as the English translation indicates, ‘to take shape’; the form, contributed by the root, is that which results from the process contributed by the root.

Something like this is also true the verbs in (5). With würfeln (in the sense indicated here, that of 'cut into cubes’) the root denotes the sort of pieces (cubes) that result in the process of cutting; its contribution are the pieces that the theme of the verb is turned into by the process the verb describes. Teilen, we want to suggest, is also to be analysed in this way. The root contributes the pieces (Teile) that are the result of the partitionary process described by the verb teilen. 6
2.2. some negative cases

Simple verbal constructions from event-denoting roots do not have \textit{-ung}-nominals; this is so irrespective of whether the verb is unaccusative (6a), unergative (6b) or non-core-transitive in the sense of (Levin 1999) (6c).

\begin{enumerate}[a.]
\item \textit{fallen} (to fall), \textit{gleiten} (to slide), \textit{sinken} (to sink), \textit{verschwinden} (to vanish), ...
\item \textit{arbeiten} (to work), \textit{husten} (to cough), \textit{wischen} (to wipe), \textit{schreiben} (to write), \textit{essen} (to eat), \textit{malen} (to paint); \textit{schießen} (to shoot); \textit{kochen} (to cook), etc.
\item \textit{einen Brief schreiben} (to write a letter); \textit{einen Hasen schießen} (to shoot a hare), \textit{eine Blume malen} (to paint a flower), \textit{einen Apfel essen} (to eat an apple), ...
\end{enumerate}

To the untutored observer the absence of \textit{-ung}-nominalisation may seem most remarkable for the third category, since in general it is typically transitive verbs that allow for \textit{-ung}-nominalisaions. Part of the explanation that we will offer for why these verbs do not have corresponding \textit{-ung}-nouns is the assumption, following Kratzer, that they are basically unergative intransitive verbs, whose structure can be expanded so as to make room for a direct object. Their basic structure as intransitive verbs and the operation that transforms these into transitive verbs makes them structurally very different from the ‘core-transitive verbs’ which allow \textit{-ung}-nominalisation. One piece of evidence for this difference is that non-core-transitives can be extended to resultative constructions, e.g. \textit{den Teller sauber wischen} (to wipe the plate clean), \textit{sich die Finger wund schreiben} (to write one’s fingers sore); \textit{einen Hasen tot schießen} (to shoot a hare dead), \textit{das Jagdrevier leer schießen} (to shoot the hunting ground empty). And they can also be used felicitously in conjunctive predicates of the type \textit{er arbeitet und arbeitet} (he works and works); \textit{er schießt und schießt} (he shoots and shoots). Core-transitive verbs do not admit resultative constructions, see *\textit{den Teller rein säubern / sauber reinigen} (to clean the plate clean), *\textit{den Hasen wegötten} (to kill the hare away), *\textit{das Jagdrevier leer töten} (to kill the hunting ground empty). Also \textit{und...und} constructions are somewhat marginal with those verbs: ? \textit{sie tötet und tötet}, ? \textit{sie säubert und säubert}, etc..

It is worth noting that many unergative verbs can be transformed into verbs that do allow for \textit{-ung}-nominalisation by applying prefixes to them. be-
is one of these prefixes, see \(7\).

\(7\)  \(\text{einen Baum malen (to paint a tree; no un\-g-noun) vs. eine T\"ur (mit Blumen) bemalen, einen Baum bemalen}^7 \) (Bemalung); \(\text{ein Haus bauen (to build a house; no un\-g-noun) vs. ein Grundstück bebauen (Bebauung)}, \)

It is interesting to compare these \(be\)-verbs with examples in \(3\) of \(be\)-verbs with nominal roots. For those verbs it is the nominal root which contributes the entity that is 'added' to the theme (realised as direct object). For the event-root based verbs in \(7\) no element of the verb structure is directly responsible for \(what\) is added to the theme. This 'what' remains implicit. Not all verbs based on eventive roots are unergative: some are unaccusative. Like the unergative verbs these lack corresponding \(-\text{ung}-\text{nouns}. Many unaccusative verbs can be turned into corresponding causatives, and some of these causative verbs have \(-\text{ung}-\text{nominals}, but not all of them. Some examples are given in \(8\).

\(8\)  \(\text{fallen, causative \(\text{\textit{fällen}}\) (-ung-noun); \(\text{h\"angen, causative \(\text{\textit{hängen}}\) (no -ung-noun); \(\text{liegen, causative \(\text{\textit{legen}}\) (no -ung-noun); \(\text{sinken, causative \(\text{\textit{senken}}\) (-ung-noun); \(\text{springen, causative \(\text{\textit{sprengen}}\) (-ung-noun); \(\text{stehen, causative \(\text{\textit{stellen}}\) (no -ung-noun) \(\text{\textit{verschwen-}}\)den (-ung-noun); \)

Interestingly, change of position verbs, such as \(\text{legen, stellen, h\"angen (to lay, to put, to hang) etc. i.e., the causative alternates of position verbs \(\text{liegen, stehen, h\"angen (to lie, to stand, to hang}) lack -ung-nominals just as their position describing alternates.\)

So far we have only drawn attention to different types of verbs that we think a viable theory of \(-\text{ung}-\text{nominalisation should distinguish. But the types we have considered are anything but a complete list, and in fact no complete list will be provided in this paper. (This is one of several respects in what the paper only tells part of the full story.)}

2.3. 'Syntactic' vs. 'semantic' structure of words?

When, two years ago, we started to look for principles that would explain when \(-\text{ung}-\text{nominalisations are possible and what they may mean we}
assumed that the answers could be found by careful attention to the aspectual properties of the underlying verbs. This seemed a natural place to look since the semantics of -ung-nouns, with event and result state as the most prominent denotation options, strongly suggested to us that aspect or 'event structure' held the key. (Moreover, as semanticists we were naturally predisposed towards solutions in terms of 'semantic categories', i.e. categories that today's semanticists consider as part of their tool kit.) In one sense this hypothesis has been confirmed — aspectual structure is essential to whether an -ung-noun can be found and to what it can mean. But in another, crucial sense, it is not. There are verbs with the same aspectual properties (at least according to the semantic classifications and tests with which we set to work on the problem), and which nevertheless behave in opposite ways when it comes to -ung-nominalisation. So it became clear to us soon that something else was involved – not just the aspectual properties with which we were working, but some deeper structure, which might be responsible for the aspectual distinctions we thought (and still think) are relevant but which nevertheless involves finer distinctions which cannot be covered from the aspectual distinctions they entail.

Our first clue as to what it was we were missing came from the works of Kratzer (s. (Kratzer 2002), (Kratzer 2005)). Crucial was Kratzer's proposal to analyse non-core-transitive verbs as verbs that 'enter syntax as intransitives'. Such transitive verbs may even be 'telic' in the sense that their most prominent uses are telic, but nonetheless they are fundamentally different from the (telic) transitive verbs that are predictable sources of -ung-nouns.

The second clue came from the proposals made within the framework of DM, especially the distinction between mono-eventive and bi-eventive verb phrases proposed by Marantz. Bi-eventuality, as we explicate it below, is the principal licenser of -ung-nominalisation. (Levin 1999) had made the distinction between core-transitives and non-core-transitives. She represents these two types with the help of semantic forms in the spirit of (Dowty 1979). Core-transitives have a semantic form as in (i), and non-core-transitive the semantic form in (ii).

\[
\begin{align*}
(i) & \quad [ [ x \text{ ACT}_{\text{manner}} ] [\text{CAUSE} [\text{BECOME} [ \ y \langle \text{STATE} \rangle ] ] ] ] \\
(ii) & \quad [ [ x \text{ ACT}_{\text{manner}}, y ] ]
\end{align*}
\]

Marantz' distinction between bi-eventive and mono-eventive verb phrases (vPs) makes it possible to represent this difference in structural terms. Core-transitive verbs are bi-eventive projections of the verbaliser v, non-core-transitive
verbs are a mono-eventive projections. To be more precise, the semantic representations determined by verbs with a bi-eventive structure are (roughly) like the semantic forms in (i) and the semantic representations determined by verbs with a mono-eventive structure are (roughly) like the ’semantic form’ in (ii). (See (9.a,b))

\begin{itemize}
  \item a. den Tisch s"aubern
  \item b. den Tisch wischen
\end{itemize}

\begin{equation}
\text{a. den Tisch s"aubern} \quad \text{b. den Tisch wischen}
\end{equation}

Central for our purpose is the role of the semantic prime ’CAUSE’. CAUSE can be a constituent of the semantic representation of non-core as well as core transitives. (With core-transitives it always is, with non-core-transitives it sometimes is.) But the decisive point is how CAUSE becomes part of the semantic representation. With core-transitives CAUSE is introduced by the interaction of two daughter nodes of vP; one of these, the v-node, introduces an activity, whereas the other represents a Small Clause or an Applicative Phrase. Mono-eventive structures give rise to non-core-transitives and transitivity is established only through the adjunction above vP. This adjunction brings — just as Kratzer’s construal of non-core-transitives — the patient argument into the structure; and in some cases it will also introduce a causal relation into the semantics, and, with that, an occurrence of CAUSE in the semantic representation. But what matters for the possibility of -ung-nouns is not whether the semantic representation contains CAUSE but how and where CAUSE gets introduced in the ’syntactic construction’ of the verb.

The difference between core- and non-core transitives is neatly demonstrated by the verbs s"aubern (to clean) and wischen (to wipe). When those verbs are used with direct objects like den Tisch (the table) the meanings of the two vPs are, while not identical, quite close. Both invite when they are used in, say, simple past tense sentences the inference that when the act was over, the table was clean. But nevertheless s"aubern and wischen are very different verbs. S"aubern is a core-, wischen is a non-core-transitive. The difference is made explicit by the structures Marantz proposes for them and
Syntactic and semantic constraints in the formation and interpretation of -ung-nouns

which we will assume here too, see [a] and [b]. Säubern is constructed from the adjectival root \(\sqrt{\text{sauber}}\), which first combines with an independently introduced argument to yield a Small Clause (or some other type of XP) and this constituent is then combined with the (activity introducing) v. (It is the combination of v with SC/XP that introduces CAUSE into the semantic representation.) Mono-eventive wischen, on the other hand, is built from a ‘manner’ root \(\sqrt{\text{wisch}}\). (Manner roots act as predicates of activities.) Here the direct object enters the scene only after vP has been formed. If CAUSE is a constituent of the semantic representation of a verb with this structure, it is contributed by the part above vP (and the way in which it is contributed is different.) What we have just seen applies to almost all cases of systematic -ung-formation that we have looked at up to the present time: the cause-result structures that license -ung-nominalisation are generated by the combination of v and its complement. (However, for a different case see section 3.5.)

2.4. Syntactic and semantic principles of constructing words from roots

2.4.1. some principles of word-syntax

The word structures we assume are built according to principles which are acceptable within DM. Specifically:

1. Word structures are built from roots and morphological elements (affixes) that function as heads in syntactic structure. Roots lack syntactic categories, which are always determined by functional heads. Functional heads may be morphologically empty.

2. There is one operation for building larger structures from constituents, viz. MERGE. (The left-right order between head and complement may be undetermined in phrase structures headed by a root, and is subject to later adjustment.) MERGE operations reflect semantic interpretation. MOVE operations reflect morpho-syntactic needs such as inflexion and word-order in overt structure. Movement of roots and other morphologically non-empty heads obeys the Head Movement Constraint, s. (Baker 1988):

\[
\text{An } X^0 \text{ only moves into an } Y^0 \text{ which properly governs it.}
\]
2.4.2. constructing semantic representations

Although much of the motivation for word-syntactic frameworks is of a semantic nature\(^9\) few attempts have to our knowledge been made to connect a formal semantics with the syntactic structures these frameworks propose. As already said, we take it that our proposal is compatible with the DM-program and might even be considered a contribution to it, but there are two differences that set it apart from other work within DM.

On the one hand we want word structures to determine semantic interpretations in a systematic, compositional fashion, just as formal semanticists require of syntactic representations of sentences that they project in a systematic, compositional way to semantic entities (such as sets of possible worlds or information states) or to transparent logical forms (formulas from some independently logical language, with its own well-defined syntax and semantics). We need such a semantic component to our theory of word structure, for without it we wouldn’t be able to make systematic predictions about the possible readings of -ung-nouns.\(^{10}\) In order to have a general account of how words are built from roots as their basic building blocks by means of certain operations, we need (i) semantic 'entries' for the roots and (ii) a semantic composition rule for the operation MERGE. These will be our central concerns in the sections 3 and 4 of the paper.

On the other hand, as we already noted in the introduction we do not see the present project as wedded to the fundamental assumptions of DM. Even if it should turn out that the principles which govern the structure of words are not the same as those which govern the syntax of phrases and clauses, then this need not be a reason for abandoning the proposal as an account of the possibility and meaning of -ung-nominalisations. (The account might then have to be reinterpreted in the spirit of a 'lexicalist' approach to grammars.\(\text{(S.(Williams 2007)\})\) Connected with these two different ways in which the substance of the present proposal could be taken is a difference that is directly relevant to how structures are built. One way, suggested by and practiced within DM, is to build verbs with their non-referential argument slots filled by actual argument phrases as soon as these slots are created.\(^{11}\) This way is illustrated in (\(\text{9a,b)\}) and it is the one adopted in this paper. The second, 'lexicalist' way is to keep the argument slots as slots throughout the construction of the verb. These slot are then filled only when the verb is integrated into a full clause. In this case a mechanism is needed — usually
Syntactic and semantic constraints in the formation and interpretation of -ung-nouns

referred to as 'linking theory' — which determines which phrases in the clause correspond to which argument slots, and where in the clause the phrases corresponding to the different slots may occur in the clause as a linear arrangement of phrases. In DM 'linking theory' is redundant, but of course the movement rules of syntax must be such that argument phrases are eventually separated from the verbs within the structures of which they are generated, so that the correct linear arrangements are reached in that way. (No structures of complete clauses are presented in this paper that would illustrate how movement leads to the right linearisation. But in section 3 we will present a complex NP, consisting of an -ung-noun and an argument phrase, in which movement does produce the correct word order.)

3. Syntactico-semantic constraints for -ung- formation

The distinction between verbs built from mono-eventive structures and those built from bi-eventive structures puts us into a position to formulate a rule for the formation of -ung-nouns. We assume that the morpheme -ung is a nominal head which merges with vP to form a nominal phrasal structure.

It is an important feature of our analysis that the n-head ung merges with vP and thus with a projection of v below voiceP. There are syntactic arguments that point to an absence of voiceP in -ung-nominals. It is known from the work of Kratzer that voiceP is responsible for disjoint reference effects: expressions whose structure include voiceP show the effect, whereas those which do not include voiceP don’t. The reason is that voice is the level at which agent arguments are introduced. Once voice phrase has brought the agent argument into play, disjoint reference between it and the theme (or patient) argument becomes an active constraint on interpretation even when no agent is explicitly mentioned. When a predicate expression does not contain voiceP, then no agent argument is represented in the structure and disjoint reference has nothing to apply to. Striking illustrations of this can be found in constructions in which past participles are in prenominal position.

(10) a. der angekleidete / angemeldete / geheilte Patient
dressed / registered / cured patient

b. der gestern angekleidete / angemeldete / geheilte
the yesterday dressed / registered / cured
The participles in (10.a) do not carry the implication that the referent argument of the noun (the patient) was dressed / registered / cured by someone else. And if the meaning of the verb forces us to assume that an agent must have been involved, as in the case of anmelden (to register), this agent could, for all the grammatical construction tells us, be the referential argument of the noun himself (he could be the one who did the registering). For the examples in (10.b) this is not so. Here the presence of the adverbial modifier gestern (yesterday) forces extra structure on the participle. Gestern requires as argument a ‘full’ event structure, including an agent. This means that the participles in (10.b) are true passive participles, which include a voice projection, unlike the participles in (10.a). As is generally the case in passive constructions, the agent need not be mentioned explicitly, but it is present in the structure nevertheless, so that disjoint reference always has a purchase here. Thus der gestern angemeldete Patient can only be understood as referring to a patient who was registered by some other person.\textsuperscript{13}

There are no disjoint reference effects in (10.c), and this is so in spite of the presence of the adjective gestrig (derived from gestern and similarly acting as eventuality predicate). For instance, die gestrige Anmeldung can refer to an event where the person who was registered on the occasion in question did so himself. This indicates that -ung-nouns never contain a voice projection, not even in cases where we might have expected that the presence of an adjective like gestrig forces such an analysis upon the noun, just as the adverb gestern does when it modifies a participle.

This argument only gives us reason to assume that -ung operates below voiceP. But how far below? One possibility would be that -ung is merged even below the point where $v$ gets merged into the structure. This might seem a natural proposal for -ung-nominals which have readings that coincide with corresponding root nominals, e.g. Wertung (from werten (to judge, evaluate), which has a reading on which its denotation coincides with that of Wert (value). Such ‘narrow circle’ nominals have been suggested for English in (Grimshaw 1990). However, data involving adjectival modification
speak against such a view. As reported in (Alexiadou 2008) even prenomi-
nal adjectives that modify nominals denoting material or abstract objects can
be interpreted as predicates of the event described by the underlying verbal
construction. Adjectival modification is a matter that needs more thorough
attention than it can be given here. So we confine ourselves to listing some
examples where the adjective must be analysed as a predicate of the event
even when the nominal is given an entity-reading. (Such examples are very
common. See (Roßdeutscher 2008))

(11) grobe Schätzung (rough estimation), grob geschätzter Wert (roughly
estimated value); fehlerhafte Übersetzung (wrong translation), fehler-
haft übersetzter Text (wrongly translated text); großzügige Bepflanzung
(generous plantation), großzügig bepflanztes Beet, (generously planted
border); eilige Meldung (urgent message), eilig gemeldete Nachricht,
(urgently read message); ...

Each of these noun phrase pairs in (11) consists of (a) a phrase whose head
is an -ung-noun N, modified by an adjective A; and (b) a phrase whose head
is a root noun whose denotation coincides with the entity reading of N and
which is modified by a phrase ‘A’P’ where A’ is the adverbial from A and P is
a past participle derived from the same root as N. The (a) and (b) phrases can
be interpreted in ways that render the (a) phrases denotationally equivalent
to the (b) phrases. This shows that even when the noun N is interpreted as
denoting an entity, the event that is the referential argument of the underlying
verb is available as argument for the adjective A. With the corresponding root
nouns the event is not denotationally available and therefore it has to be made
available, e.g. through addition of the N-related participle P. (For instance
grober Wert is not really acceptable — although, if it meant anything at all, it
would presumably mean something like grob geschätzter Wert.) This means
that the event described by the verb which shares its root with the N must be
available as predicable for the prenominal A.

These considerations bring us to Hypothesis 1.

**Hypothesis 1**

-ung operates above vP and below voiceP.

The next Hypothesis is central to the explanation we will offer of when
-ung-nominalisation is possible. It states a constraint on when and where -ung
can be merged: -ung may be merged with a vP (or a projection of vP) only
if the vP contains a ‘syntactically transparent’ cause-result structure (which translates into a condition of the form ‘e CAUSE s’ when the vP is mapped into its semantic representation). (One can think of this as a kind of selection restriction on the operands of the operator -ung. Admittedly this is a selection restriction of a rather unused form. We do not know whether it could be derived from principles of a more familiar sort.) We repeat this constraint explicitly as Hypothesis 2.

**Hypothesis 2**
-ung requires as input a ‘syntactically transparent’ cause-result structure. In most cases this structure results from the combination of v (introducing an event e’) and its complement (introducing a state s,) and which contributes the condition ‘e’ CAUSE s’ to the semantic representation of vP.

Such cause result structures always arise in cases where the complement of v contributes a state s. The event e’ introduced by v, being categorially distinct from s, cannot be unified with it, so the relation between e and s that is expressed by the combination of v and its complement must be some other relation than identity. In the cases that we have looked at so far the relation is always causation: e’ causes s.

This leads us to the first prediction of this paper: core-transitives, with their bi-eventive structures (see (9.a)) in which the v head is combined with a (state describing) Small Clause, permit -ung-nominalisation; non-core-transitives (see (9.b)) with a structure in which v is merged with a ’manner’ root, do not give rise to a cause-result interpretation — here the root simply acts as a predicate of the activity, introduced by v — and therefore do not permit -ung-nominalisation.

We note in passing what has been said about the interpretation of v-complement structures shows that the semantic rule corresponding to MERGE can be expected to be quite complex. The contribution that the v-complement combination makes to the semantic representation of vP varies as a function of the form of the complement. And combining v with its complement is only one of many consistent combinations that in Minimalist Syntax are described as cases of MERGE.

In the following we will work through some examples in order to show how Hypothesis 2 works and to indicate how it enables us to explain the possibility or impossibility of -ung-nominalisation for a wider range of cases.
3.1. verbs constructed from property denoting roots

Assuming that property denoting roots merge with a complement phrase which introduces the entity to which the property denoted by the root is applied\textsuperscript{14} we get the syntactic representation (12.b) for the derivation of the noun *Trocknung* and its thematic argument *der Biomasse* from its underlying deadjectival base. The structure emerges from two operations of head movement (expressions in angled brackets, e.g. ⟨√trocken⟩, indicate traces).

\begin{equation}
\begin{array}{c}
(12) \\
\text{a (die) Trocknung der Biomasse} \\
\quad \text{(the) dry+ung of the organic matter}
\end{array}
\end{equation}

The complement of r becomes the (internal) argument of vP and is then related to the event e’ introduced by v. (Structural case assignment in (12.b) follows assumptions that are widely shared\textsuperscript{15}.) The property root \textit{trocken} combines with its complement \textit{die Biomasse} to yield a stative predication at rP which then combines with v to yield vP. -ung can apply to this vP because the combination of v and its complement yields a cause result structure involving the event e’ introduced by v and the state of the stative predication at rP. Application of -ung- is assumed to involve head movement of the root √trocken to v and in turn movement of the complex v-head to the n-head to form the phonological output *Trocknung*. The construction of the semantic representation that makes these explanations of (12.b) explicit is given in (13).

Combining the root with its complement amounts to predicating it of the complement’s referential argument. This predication has the status of a state, and the predication state s is introduced as part of the combination — see the semantics construction of rP. Combining this representation with the event e’ introduced by v e’ is interpreted as the event which brought about the state s.
We assume that it is part of this operation that s is existentially bound. (This is effected by transferring s from the store to the universe of the DRS).

Furthermore, since the merge of v with its complement makes the referential argument e' into a state change causer, we get as part of the representation the prestate presupposition that is typical of change-of-state predicates. This presupposition says that the internal argument y is at the time when e' starts in a state s₀ of not being dry. The nominaliser -ung doesn’t alter the semantics of the vP as such. The only difference that occurs in the transition from vP to nP has to do with what acts as referential argument. While e' is unequivocally
the referential argument of the predicate represented by vP, the referential argument of the nominal predicate (i.e. the -ung-noun Trocknung) can be either the event e’ or the result state s. In (13) this ambiguity has been captured by making the semantic representation underspecified with regard to the question whether the referential argument α is e’ or s. ( ∨ is an underspecification operator, and not a normal disjunction as in ‘α = e ∨ α = s’). It indicates that when an occurrence of Trocknung is interpreted, one of the two options must be chosen (see (Reyle, Rossdeutscher and Kamp:2008)).

3.2. interlude: non-core-transitives

Let us for the sake of comparison now construct the semantic representation of a vP involving a non-core-transitive. As example we have chosen eine Blume malen, for which the syntactic structure is as in (12)b. The semantic representation that can be derived from this is given in (14)b. The construction starts with the denotation of the root √mal. (We assume that the entry for √mal tells us that its semantic is that of an event predicate which we present as λe.PAINT(e)). Merging v with its complement has the semantic effect of λ-conversion: λe.PAINT(e) is applied to the discourse referent e’ introduced by v. Informally we can describe this as: ”the root acts as a modifier of little v”, or, ”semantically the root acts as predicate of the event introduced by v”. Note that here the direct object eine Blume is not analysed as complement in an rP which in its turn is the complement of v, but as the internal argument of a PP with an empty P-head which is an adjunct to vP. This is, as we already saw, the crucial difference between a non-core-transitive like malen and a core-transitive like trocknen. Since the PP is merged above the (lower) vP, we don’t get a cause-result relation, and thus no -ung-nominalisation. The interpretation of the tacit preposition has been left underspecified.

(14) a. eine Blume malen
    a flower paint
The lexical content of the root √mal (which we have made no effort here to spell out in any detail), arguably entails a causal relation between the painting event e’ and the flower picture that results from it. We can represent this causal aspect of the meaning of (14.a) by representing the existence of y at the time when e’ is finished as the obtaining of a ‘result state’ s of e’ which consists in y’s existence. This can be represented by the conditions ’s:EXISTS(y)’ and ‘e’ CAUSE s’. In this way the meaning of √mal allows us to expand the semantic representation of the vP into the one given in (15).

The difference between the two examples we have so far looked at — trock-en with its -ung-noun and malen without a corresponding -ung-noun — seems to depend on the difference between the roots √trocken and √mal: trocken is a property root, which leads to a causally interpreted bi-eventive structure at vP; √mal is an eventive root, which combines directly with v
and acts as a predicate of the event that v introduces. It is noteworthy in this connection that Hypothesis 2 does not make any explicit reference to such properties, given that is only certain properties that lead to the eventive structures that Hypothesis 2 identifies as essential to the possibility of -ung-formation. 18

3.3. be-alternates

In section 2 we noted that many prefix-verbs with be- have corresponding -ung-nouns. This is true also for many be-verbs where the corresponding stem verbs do not have an -ung-nominalisation. The pair malen, bemalen is an example of this. Such pairs pose the following problem, which is as much a problem about the structure of prefix verbs as it is for the theory of -ung-nominalisation. The structure for eine Tü r bemalen is given in (16).

(16)

The reader will have no difficulty in seeing that given our Hypotheses 1 and 2 this structure predicts that -ung-nominalisation is possible, and indeed, that is just the prediction we should get. But the thought may well occur to him that in this way we can obtain any prediction about possibility or impossibility of -ung-nominalisation to come out just the way we want. Intuition tells us what eine Tü r bemalen means: carry out an action which leads to the result that the door is painted. But we have already argued that there are cases of resultative meaning (e.g. with non-core-transitives like schreiben or malen) where the cause-result relation is owed to a word-formation operation at some projection level above vP and which do not have -ung-nominalisations. Sometimes, in other words, the cause-result relation is assumed to be 'low down' in the word semantic structure (by the merge of v and its complement) and then it licenses application of -ung; and in other cases it is assumed to be introduced 'high up', and then it doesn’t license it. If we could freely decide for each verb or verb class involving a cause-result relation were and how to introduce that relation in the structure of that verb (or of the verbs of that class)
then our ‘explanation’ of when nominalisation is possible wouldn’t amount to very much. In order that the explanation has any bite we need independent principles that tell us where the cause entailing steps in the construction of word-structures belong.

Some collateral evidence for these principles will emerge in section 4, where the possible readings of -ung-nouns will be discussed. Another piece of evidence will be discussed in the next subsection 3.4.

3.4. verbs constructed from ‘nominal’ roots

This piece of evidence has to do with be-verbs that are built from nominal roots, such as for instance the verb bestuhlen (see (3) in section 1.2). A vP like einen Saal bestuhlen (to furnish a hall with chairs/seats) is to be understood as the bringing about of a state which consists in the obtaining of a certain relation between the direct object (the hall) and entities of the sort denoted by the root √stuhl. For a verb like this a structure like (17) strikes us as intuitively plausible: there is a Small Clause that is obtained by combining root and direct object and this Small Clause is then combined with v in the way we have seen before (see the discussion of trocknen in section 3.1.). The combination gives rise to a condition ’e’ CAUSE s’ in a way which licenses -ung.

(17)

According to this structure the event e’ introduced by v is, as it was in our analysis of trocknen, a mere state-changer and the verb represented be (17) a pure change-of-state verb. be- verbs with manner-roots like bemalen are different in this respect. Here the event e’ introduced by v comes equipped with the manner predication ’M(e’)’ where M is the predicate contributed by the manner root. This difference correlates with another one. In (16) the non-referential argument of the preposition be- has no overt filler. Reflection on the relation between malen and bemalen — as well as on similar
cases, in which a non-core-transitive creation verb can be turned into an -ung-nominalisable be-verb — shows however that the reconstruction of the tacit argument of be- in bemalen is restricted to precisely the same sort of entities that can serve as direct objects of malen. (Note that die Tür bemalen cannot mean that the door has been given a coat of paint (which is one of the possible meanings of malen). Die Tür bemalen can only mean that representations have been painted on the door, as in die Tür mit Blumen bemalen. (Compare fn. 7.) This means that the manner root √mal, which is solely responsible for the semantics of the verb malen, also plays a decisive part in the interpretation of the non-referential argument of be- in bemalen.

This similarities between bemalen and bestuhlen lead naturally to the thought that the prepositional head be- must be constructed as semantically relating two non-eventive entities: (i) the internal argument of vP, e.g. the door, and (ii) a silent argument, which in the case of bemalen is a pictorial representation. This eliminates the possibility that be- contributes a relation between the internal argument and the event e’ introduced by v. On the one hand this accounts for why Bemalung exists. If bemalen just expressed a relation between the internal argument (die Tür) and e’ there would be no cause result structure and thus no -ung-noun. On the other hand it also explains why die Tür bemalen/ die Bemalung der Tür cannot just mean that the door is given a coat of paint but only that it is covered with representations.

3.5. causatives of intransitives

In (8) (section 2) we presented examples of intransitives and their causative alternates. Recall the relevant facts: intransitives like fallen or verschwinden lack -ung-nominalisations, while their causative alternates admit them. But for position verbs like liegen or hängen this is not so. Causative legen and hängen have no -ung-nouns any more than their intransitive counterparts. So the question arises: Why do we find Fällung and Verschwendung but no Hängung or Legung?

We take it to be consistent with assumptions made by current syntax that causatives are built from structures from the underlying intransitives and that the transition from intransitive to transitive is effected by an additional operation at the level of voice. More specifically, let’s assume that the structure of, say, den Baum fallen is as in (13).
With unaccusatives like *fallen* and *verschwinden* causativisation as represented in (18) is possible only when the event described by the intransitive verb has a natural culmination. This condition is satisfied by a tree that falls down and comes to rest in a horizontal position on the ground. It is this telic aspect of *fallen* in the sense of ‘fall down’, we will argue, that plays an essential part in licensing *Fällung*. The same goes for *verschwinden* and *Verschwendung*.

The structure in (18) should account for two things; (i) Why don’t we find the noun *Fallung*? The non-existence of *Fallung* must follow from the structure of the vP which *fallen* and *fallen* share; and (ii) Why do we find the noun *Fällung*? That there is no noun *Fallung* might seem puzzling in the light of what we have said about *trocknen*, for on the face of it the vPs for *fallen* and *trocknen* look exactly the same. The crucial difference has to do with the nature of the roots √fall and √trocken. √trocken, we said earlier, is a property root which combines with the complement of r to yield a predication which assigns that property to the complement’s referential argument. √fall, we are assuming, is a different type of root, typical of unaccusative intransitives, in which the non-referential argument is generated internal to vP. Such roots express a relation between the referential argument of the verb that is contributed by v and this ‘internal argument’ (which here too is contributed by the complement of r). Thus the meaning of √fall can be represented schematically as λyλe FALL(e,y). Combining this condition with the r complement instantiates the λ-bound y to the discourse referent z representing the complement’s referent, leading to λe FALL(e,z). When this representation is combined with the event discourse referent e’ contributed by v, we get another λ-conversion, yielding the event predication FALL(e’,z). So in this case we don’t get a cause-result structure at the level of vP, and consequently *-ung*-nominalisation is not possible.

The explanation why *Fällung* is possible, while *Fallung* is not contains
a number of new elements. First, observe that the verb *fallen* has, like the English verb *to fall*, two different uses: (a) move involuntarily in a downward direction, propelled by gravitation and (b) fall over, and thereby change from an upright into a prostrate position. In this second use *fallen/fall* is telic in the sense of having an intrinsic result state, and it is only *fallen* in this sense that can serve as basis for the causative *fählen*. We interpret this fact as meaning that it is part of the construction of *fallen* that the interpretation of its ‘*fallen*’-part — that is, the semantic representation associated with vP, the lower part of (18) — is enriched with information that distinguishes this sense of *fallen* from the first sense (involuntary motion in a downward direction). Moreover, it is the telic aspect of this meaning of *fallen* which is responsible both for licensing the adjunction of the cause operator and for the possibility of MERGE with -*ung*- above that operator that gives us *Fällung*. We assume that the choice of ‘fall over’ meaning of √*fall* permits the expansion of the semantics of the lower vP of (18) to the structure in (19)

(19) \[ e', \begin{array}{l}
  \text{FALL}(e',z) \\
  s: \text{prostrate}(z) \\
  e': \text{CAUSE } s
\end{array} \]

Note well that this expansion is not a structure-induced operation and therefore not one that can license *-ung*-nominalisation in and of itself. Hence there is no basis for the formation of *Fällung*. We further assume that the causativity operator acts as a new ‘v head’ which introduces an event discourse referent e” and that the combination of this head with the lower vP is interpreted as a causal relation between e” and e’. In combination with the condition ‘e’ CAUSE s ’ in the extended vP semantics of this vP node given in (19) this causal relation yields ‘e” CAUSE s ’. This is an instance of a special kind of causal transitivity: by causing the event e’ that leads to a given result state s. The event e” *ipso facto* causes s. We assume that this transitivity is transparent to the interpretation of syntactic structures, and thus that the condition ‘e” CAUSE s ’ becomes part of the semantics of the upper vP node in (18). It is the presence of this condition in the semantics of the upper vP node and its partly structural origin which then licenses the MERGE with the -*ung*-head and hence the existence of *Fällung*.

If this is the story about *fallen, fählen, *Fallung and Fällung*, how does it gibe with the facts we have noted about position verbs and their causatives, such as *liegen and legen* neither of which have corresponding -*ung*-nominals?
It might seem that when we try to account for the difference between the two cases we are facing a rather hopeless task. On the one hand we have argued, the expansion of the interpretation of the lower vP node in (18) to the cause-result-condition in (19) is needed to license the adjunction of the causativity operator, and the interpretation of the upper vP as involving the condition ‘e’ CAUSE s’. And then this licenses in its turn -ung-noun formation leading to Fällung. What does this tell us for the case of liegen and legen? On the one hand, it would seem that the lower vP in the structure for legen must license the causativity operator by supplying a state s, so that the upper vP can be interpreted as involving a condition of the form ‘e’ cause s’. Arguably that state could be supplied by the root √lieg (from which, we assume, liegen and legen are both built). But once we have obtained the condition ‘e’ CAUSE s’ nothing would seem to stop us from also building the -ung-nominal Legung, which, as we have noted, does not exist. It pretty much looks like we are stuck!

The solution to this riddle is, we conjecture, as follows: The difference between fallen and liegen is that fallen is an unaccusative verb; its non-referential argument is generated vP-internally. Legen, in contrast is an unergative verb, with what we have been calling a ‘manner’-root; its external argument is introduced — like, say, that of intransitive and transitive malen — at the level of voiceP. Moreover, the causativity operator requires not just a result state, but also, by implication, the argument, that this state is about. With an unaccusative this argument is already present at vP, so that, given that there is also a (result) state of the argument having a certain property, the causative operator can adjoin to vP. In the case of the unergative liegen, however, it is only at the level of voiceP that the structure contains the external argument; so, assuming that liegen can be interpreted as providing a state (to the effect that the argument is in a lying position) the causativity operator can be adjoined there. But this means that the operator can be adjoined only to or above voiceP. So it will only be above voiceP that the condition ‘e’ cause s’ will be available that -ung needs as licenser. But that require that -ung be adjoined above voiceP and we have argued that that is not permitted.

It this is right, then the structure of causative legen is quite different from that for a causative like fallen. But the story we have just been telling is only a sketch, with many loose ends. One of our first project for the immediate future is to investigate the viability of this analysis of position verbs and their causatives.
4. What are the possible readings of -ung-nominals?

Up to this point we have addressed only one of the two problems on our agenda: when is -ung-nominalisation possible and when not? We have accounted for the possibility of -ung-nominalisations in terms of the internal structure that we have assumed for different types of verbs; only when these structures have a certain property — a cause-result relation generated by the structure in a certain way — is nominalisation possible. Moreover, when -ung-nominalisation is possible then the resulting -ung-noun shares most of its structure with the underlying verb. Even if this could be seen as an accomplishment in its own right, it would certainly be desirable that the internal structures which the theory ascribes to the different -ung-nouns could also be used to account for their possible readings. In this section we will sketch how this may be accomplished.

We will distinguish four types of -ung-nouns that represent four different ‘ambiguity profiles’. Here by an ambiguity profile we mean a set of different readings. There are three different readings for -ung-nouns we will consider: (i) event readings; on such a reading the referential argument of the noun is the same as the referential argument of the vP-node of its internal structure (which will also be the referential argument of the underlying verb; so when the verb is used with this reading the noun can serves as an alternate to the verb.) (ii) the target state (in the sense of (Parsons 1990)) of the event in (i) (assuming of course that there is a target state); (iii) an entity that has been created through the event in (i) and which moreover plays an essential role in the event’s target state. We will refer to these three readings as ‘ev’ (for event), ‘s’ (for target state) and ‘ent’ for entity. The four profiles we will consider are non-empty (but not necessarily proper) subsets of the set \{ev, s, ent\}. For each of these profiles we will give an example of an -ung-noun for which this profile coincides with the set of its possible readings. Each of the four nouns represents a class of nouns that share its profile. These classes can be characterised in terms of the internal structure of the nouns belonging to them. We refer to the four classes as ‘Type 1’ — ‘Type 4’, respectively. The instances of these four types that we will look at are the nouns (1) Trocknung, (2) Mischung, (3) Pflasterung and (4) Bearbeitung. The table in (20) gives these nouns with (i) their meaning-profiles and (ii) the corresponding verbs.
All four types have event readings. In fact this appears to be the case for all -ung-nouns that can be formed with the help of currently productive principles.

Type 1. That Trocknung is ambiguous is illustrated by the NP eine leichte Trocknung (a slight/easy drying). This phrase can either be interpreted as referring to an event of slightly drying (that is, an event of bringing about the state that something is slightly dry) or a drying event that was easy in the sense of easy to carry out. But leichte Trocknung can also describe the state that consists in something being slightly dry. (Internet searches confirm this.) As we have seen in section 2 trocknen is built from an ‘adjectival’ root, which forms a Small Clause with the theme argument, and where the Small Clause then enters into a causally interpreted relation with v. This is what characterises the (verbs) and nouns of Type 1.

Type 2. The two possible meanings of Mischung can also be brought into focus by combining the noun with prenominal leicht: eine leichte Mischung can either mean an event of mixing that was easy (as with Trocknung) but it can also be understood as referring to the natural result of the mixing, i.e. to the mixture, and say of it that was light (i.e. doesn’t weigh much). Mischen, we assume, is built from a sortal or ‘nominal’ root √misch which denotes the entity which results as a product of a process that can be described by mischen and which stands to the direct object of mischen (the substances that are mixed together) in a certain mereological relation. Similar examples are sammeln and (sich) formen. (In these two cases the entity that can be referred to by the -ung-noun (Sammmlung, Formung) is related to the thing or things or stuff that is subjected to the process described by the verb by a relation that is better described as ’configurational’ than as ’mereological’.) The characteristic feature of Type 2 verbs and nouns is this: the root is sortal, it contributes an entity that results from the described event or process and it stands in a mereological or configurational relation to what the event or process acts on. For reasons of space we refrain from presenting the internal structure of such verbs and nouns and their corresponding semantics.

Type 3. Pflasterung has all three of the possible meanings ev, s, and ent. Here too we are dealing with a verb (and corresponding -ung-noun) that is
built from a sortal root. But the roots of verbs of Type 3 differ from the roots of verbs of Type 2 in the kind of relations between the entity denoted by the ent reading and the ’affected theme’ (the thing or things or stuff available at the start of the event or process described by the verb and transformed or affected by it). In fact, in the case of Type 3 verbs the ’affected theme’ is distinct from the ’used material’. This is witnessed by the use of such verbs in which the first is realised as direct object and the second by a mit-PP, as in den Platz mit Ziegelsteinen pflastern (to pave the square with tiles) and also in its nominalisation die Pflasterung des Platzes mit Ziegelsteinen (the pavement of the square with tiles). Especially this last phrase is revealing: Here there clearly are three affected entities: (i) the square (affected theme) (ii) the material used and (iii) the pavement of the square that the tiles have been made into (the entity denoted by Pflasterung). Here the relation between pavement and tiles is the kind of relation we found with verbs of Type 2 but the relation between -ung-entity and theme (i.e. between pavement and square) is of a different kind. The pavement is an addition to the square in a sense in which, say, a mixture is not an addition to the ingredients that have been mixed.

For good measure we display the structure and semantic representation of the vP einen Platz pflastern (to pave a square) in (21).

What Type 2 and Type 3 have in common is that both involve sortal roots. We conjecture that all -ung-nouns that are built from sortal roots have entity-readings and that when they are given an entity reading their denotation is always the entity introduced by the root. A special case are be-verbs with nominal roots, for instance bestuhlen, for which we gave the structure in (17) in section 3.4. Recall that here the entity contributed by the root √stuhl acts as non-referential argument of be-. This also leads to three readings for the corresponding -ung-noun Bestuhlung: (i) the event reading; (ii) the entity reading in which the noun refers to the chairs or seats with which the theme has been furnished, and also (iii) a state reading where the state is that of the theme having been provided with seats or chairs.
It is worth noting that the Type 3 profile of -ung-noun readings can also be found with many be-verbs whose roots are manner roots, such as bemalen or beschreiben. We already discussed the structure of bemalen in section 3.3 and argued that this structure licenses the -ung-noun Bemalung. Bemalung, too has all three readings —, the event reading, an entity-reading in which it refers to the pictorial representation that has been painted onto the theme (e.g. a door) in a process that can be described either as malen or bemalen, and a state reading which refers to the state of the theme having had some pictorial presentation painted onto it.

Bemalung differs from Bestuhlung and the other examples of -ung-nominalisations with entity readings in that its structure does not involve a sortal root. So it confronts us with the question: How does the entity reading come about
in this case?

This is the answer we propose. We noted in section 3.3. that the structure of \emph{bemalen} differs from that of \emph{bestuhlen} in that the non-referential argument of \textit{be}- is empty. But, we also hinted, this argument gets reconstructed according to a well defined principle. Let us pursue this thought a little further. \textit{Malen} is typically used as a (non-core) transitive verb which encourages telic interpretations. For instance, the sentence \textit{er hat eine Blume auf die T"{u}r gemalt} (he painted a flower on the door) allows for the telic interpretation according to which the act of painting a flower on the door was completed. (We can also express this using the verb \textit{bemalen}, viz, as \textit{er hat die T"{u}r mit einer Blume bemalt}). It is the theme of such transitive uses of \textit{malen} — viz. the pictorial representation that is produced — that must be reconstructed as non-referential argument of \textit{be}- in \textit{Bemalung}. And just as with \textit{Bestuhlung} it is this non-referential argument of \textit{be}- that licenses the denotation of \textit{Bemalung} in its entity-reading.

What we see here in connection with \textit{Bemalung} is reminiscent of what we suggested earlier in relation to \textit{fallen} and \textit{f"{a}llen}. An aspectual feature — the possibility of putting a telic interpretation on a certain verb — affects \textit{-ung}-nominalisation. This is in the spirit of our intuitions with which we started our investigation of \textit{-ung}-nominalisation according to which it should be possible to explain the properties of this operation in terms of just such aspectual properties. But note how far we have in fact moved from those original intuitions. At this point it is roots which have the aspectual properties that produce these effects, and they do so via structural assumptions that are quite alien to nearly all of the semantic work on tense and aspect that can be found in the semantics literature.

**Type 4.** The interaction between semantic and syntactic structural factors is further illustrated by the \textit{-ung}-noun we have chosen as example of Type 4, viz. \textit{Bearbeitung}; like \textit{malen} the verb \textit{arbeiten} (to work) is an unergative, built from the manner root \sqrt{arbeit}. But in contrast to \textit{malen}, \textit{arbeiten} has virtually no uses as transitive verb. \footnote{Like \sqrt{mal} \sqrt{arbeit} can be used as building block in the structure of a \textit{be}-verb, viz. \textit{bearbeiten}. We will assume that the structure of \textit{eine Akte bearbeiten}, given in (22) is like that of \textit{eine T"{u}r bemalen} proposed in section 3.3, s. (16).}
Like (16) (22) presents us with the question what determined the non-referential argument of be-. But note that the reconstruction that we described for the case of bemalen doesn’t work in the case of bearbeiten. Malen is a non-core-transitive verb of creation which admits of natural telic interpretations; arbeiten is a typical activity verb, used to describe events without natural culmination. Because of this difference the reconstruction of the non-referential argument of be- proposed for bemalen is not available here. But then, how is this reconstruction problem solved in the case of bearbeiten?

There is a quick answer to this question and a better one. The quick answer isn’t really tenable, but the better one is rather long. I’ll compromise by giving the quick answer, indicate where it is lacking, then give some hints of what the better answer would be like and what would have to be done to provide the background that it presupposes.

The quick answer goes as follows: neither in the root of arbeiten nor in the structure of bearbeiten is there anything that could be used to reconstruct the non-referential argument of be-. So this reconstruction problem remains unresolved and since it remains unresolved no proper (result) state is defined at the Small Clause level of the be-predication. As a consequence there is no entity that could become the referential argument for an object reading of Bearbeitung; nor is there a proper target state that could become the referential argument for a target state reading. This entails that the only possible reading of Bearbeitung is the event reading and thus that its profile is \{ev\}. This is in agreement with speakers’ intuitions (and confirmed by the corpora we have looked at).

This is the quick answer. What is unsatisfactory about it is that it implies that the semantic representations of bearbeiten and Bearbeitung are in fact defective. If there is no possible reconstruction of the non-referential argument of be- and therefore no well-defined Small Clause state exists, then there is no well-defined cause-result relation and it is unclear what would license the -ung-nominalisation operation, and thus whether Bearbeitung is a rule based case of -ung-derivation at all (leaving aside what it might mean).
That some kind of licensing is required that, at a minimum, involves conceptualisation of a well defined result state is indicated by the fact that there are cases of an unergative stem verb with no or only marginal uses of non-core-transitives for which there does exist a corresponding be-verb, but no corresponding Be-...ung-noun. An example is nagen (to gnaw). Benagen exists, as in einen Knochen benagen (to work on a bone by gnawing on it (in the manner of a dog, say). But Benagung doesn’t exist, neither according to standard lexica of German nor, it appears, in the mind of German speakers. The relevant difference between the cases of (be)nagen and be(arbeiten) is that in the first case both stem verb and be-verb are atelic, whereas in the second the stem verb is atelic but the be-verb allows a telic interpretation. For instance, die Akte in drei Tagen bearbeiten (to work through the file in three days) is felicitous, whereas den Knochen in drei Stunden benagen (which might mean something like ‘to work on the bone by gnawing at it in three hours’ if it were grammatical) is not.

So a proper account of the structure and semantic representation of be-arbeiten and Bearbeitung involves more than the quick answer provides us with. These difficulties can be avoided if we assume that some kind of reconstruction of the non-referential argument of be- does take place in the case of bearbeiten too, leading to the effect that the Small Clause interpretation is a construction of the resultant state which locates itself immediately after e’ together with a condition that says that the direct object stands in a patient relation to e’. In that case there is a SC-state that can be interpreted as the causal result of e’, thus licensing the word Bearbeitung; on the other hand it is still possible to explain the absence of an entity-reading of Bearbeitung as a consequence of the fact that no entity has been reconstructed as non-referential argument of be-; and the absence of a result state reading can be explained on the assumption that only substantial states (e.g. target states of telic verb phrases) can be the referential arguments of nouns, but not a purely formal resultant state, whose substance is reduced to a mere temporal location.

5. Conclusion

The central aim of this paper was to explain the possibility of -ung-nominalisation and the semantics of those -ung-nouns that exist. Our general approach to these questions has been to develop a theory of the internal,
root based structure of verbs, building on work within Distributed Morphology. New is to our knowledge to endeavour the morpho-syntactic structures familiar from DM with a formal semantics, given here in the form of DRT-based semantic representations. However, the interface of these two modes of representation has only been illustrated in this paper. A more systematic development of such a syntactic-semantic theory of word structure is a major enterprise and accounting for admissibility of -ung- nominals is just one of its several applications. Another areas of application, of which some glimpse became visible could be seen as we went along, is the syntax and semantics of prefix and particle verbs. The only such verbs we looked at here were verbs beginning with be- but German (like other central and East European Languages) is notoriously rich in such verbs and the processes of forming them is, like -ung-nominalisation, semi-productive. The interpretation of certain types of German particle verbs is one of the tasks of the research project within which we are also exploring -ung-nominalisation, and case studies of some of those verb types that make use of the same DM-DRT based frames are underway.

In this paper we have only presented structures that end roughly where the formation of the intended word was completed. From the perspective of DM these structures only go part of the way; complete structures are structures of complete sentences. Going this whole distance was not a purpose of this paper, but if we are right, there is nothing that stands in the way of this. From the perspective of DRT implication of a theory that starts from roots rather than words seems even more dramatic: discourse representations not just of simple sentences but of multi sentence text and dialogue, now trace the entire distance from root to discourse.

Notes

1 Compare (Williams 2007).

2 Among the -ung-nouns we have preliminarily put aside are those of which we suspect that they have entered the lexicon as technical terms, e.g. Kochung (a way of making paper), Abschreibung (amortisation), Abtreibung (abortion), Anhörung (a session during which the parties to a law suit are being interviewed by a judge). There are also nouns ending on -ung which seem to defy systematic treatment altogether, e.g. Zeitung (newspaper), Gattung (species), Bösung (embankment). These are some -ung-nouns for which there does not exist a verb with the same root. Then there are cases where for all we know noun and verb are built from the same root, but where the meaning of the noun appears to stand in no systematic
relation to the meaning of the verb. Examples are 
Währung (currency), Spannung (tension). And finally there are -ung-nouns which would appear to be counterexamples to the theory we will present. An example is Meinung. On the one hand the verb meinen should not, according to the theory, permit the derivation of an -ung-noun. On the other had, Meinung does not have an 'event' reading, a reading that is generally possible for the -ung-nouns that are derivable according to the theory.

3It will become increasingly clear as we proceed that the present theory requires quite detailed assumptions about the properties of roots. Some of these properties have a distinctive 'grammatical' flavour which makes it odd to classify them as purely 'encyclopaedic'. In fact the properties that we will be assuming may appear to some DM-theorist to be incompatible with a basic conception of DM according to which all that roots do is to contribute no more than bearing purely 'encyclopaedic' information that has no bearing on what structures can be from them.

4Caution is needed, however. How can we be sure that erröten is an activity and not a change of state verb? Why does the root act in this case as a description of an ongoing activity (as in 'become redder') rather than the description of a result state ('reach the state of being red')? This question seems to gain additional weight when we note that the verb (sich) röten does have a corresponding -ung-noun, viz. Rötung. If we are on the right track, then sich röten must be a change-of-state verb. But in this instance it is certainly not easy to tell on the basis of our semantic intuitions that there is such a difference between sich röten and erröten. This is a case where it seems that the best one can do is to take one's clues from the indirect evidence that is provided by the overall success of one’s theory.

5This diagnosis is supported by the fact that sterben admits a resultative construction, as in die Freunde sind alle weggestorben (lit. the friends all died away), a construction that is only possible with eventive roots. See section 2.2, below.

6The verb würfeln exemplifies another general moral. Besides the meaning just considered this verb also has another meaning, viz. to 'throw dice'. But there is no -ung-noun corresponding to this verb. In our terms this can only mean that there are two structurally distinct verbs würfeln. The verb that means 'throw dice' is also built from a nominal root √würfel but in a different way than the verb 'cut into cubes'. (In fact, it is doubtful whether the roots involved in these two meanings of würfeln are really the same. The German noun Würfel in ambiguous between 'cube' and 'die' and it is quite possible that we have really two nouns built from distinct roots (though there is no question that they would be historically related.) In that case we would presumably also have two distinct verbs würfeln built from different roots in different ways.) Structural differences between what looks at the surface like a single word are not uncommon in German. Many such cases are found among prefix- and particle verbs. One such example is aufheben, which has three meanings: (i) to pick up from the ground; (ii) to keep (for later use, say); (iii) to lift, in the sense of 'lift a ban/prohibition'. The derived -ung-noun Aufhebung exits only with the meaning corresponding to (iii). Here too different internal structures are responsible for different different meanings.

7Note the difference between einen Baum malen and einen Baum bemalen. The first means 'make a representation of a tree', the second 'paint a tree' in the sense of putting paint on a tree. Note, however, that einen Baum bemalen can only mean that pictures are painted on the tree. The case of a tree that is painted with luminous paint so that drivers can see it in the dark cannot be described with bemalen (one would say mit Leuchtfarbe anmalen / versehen in this case.) We will return in more detail to malen and bemalen in sections 3 and 4.
8 Stellung exists, but it does not have the event denotation it should have had if it were derived from stellen according to the general principles we will present.

9 e.g. (Hale and Kaiser 2005), (Marantz 1997), (Harley and Noyer 2000), (Alexiadou 2001).

10 Also, though this is of no direct relevance in the context of this paper, we want our word structures to yield semantic representations from which it is possible to build semantic representations of sentences.

11 We assume that both verbs and nouns have one referential argument and zero or more non-referential arguments. The referential argument of a verb is the eventuality it describes. Verbs always have at least one non-referential argument slot, which will be filled by the grammatical subject when the verb is used in the active voice. Simple transitive verbs will have two non-referential argument positions — for subject and direct object in active voice uses of the verb —, and so on with other verb types.

12 (Kratzer 1996), (Kratzer 1995), see also (Stechow 1996).

13 For more discussions, see (Kratzer 1996), (Kratzer 1995), (Stechow 1996), (Roßdeutscher 2000).

14 (Alexiadou 2001) also proposed complements in root phrases.

15 e.g. (Sternefeld 2007), (Marantz 2000).

16 It is essential to the approach we pursue that properties of roots are relevant to what structures can be built from them. For instance, that √trocken is a property root is something that is part of this root’s specification, together with its ‘encyclopaedic’ semantics. The general implication of this is that grammar must be supported by a ‘root lexicon’ which specifies both the structurally relevant properties of individual roots and the aspects of their meaning that are ‘structurally irrelevant’. As things stand, we are not clear what general form a root lexicon should take, and what kinds of information about individual roots it will have to provide. Here we will only make incidental assumptions on about what this ‘lexicon’ tells us about particular roots.

17 The representation (14b) gives just one of the interpretations of the phrase eine Blume malen, that in which the direct object denotes the representation that is produced in a painting event. According to the other interpretation the direct object denotes the original (the actual flower) of which the pictorial representation is being made. In this case the relation between y and e’ is evidently a very different one, while the resulting picture is left implicit.

18 It should also be noted that some roots are ambivalent between different types. An example is the root √zeichnen. On the one hand the word zeichnen acts as a core-transitive, which licenses the -ung-nominalisation Zeichnung. On the other hand zeichnen also acts as an unergative verb, something that is shown by the possibility of resultative secondary predications, as in er hat sich die Finger wund gezeichnet (‘he drew until his fingers had weals’). It appears from that we either have to assume that there are two roots √zeichnen belonging to different root classes and giving rise to verbs with different structures or else that there is a single root √zeichnen but that this root is underspecified with regard to the class it belongs to.

19 There is a special transitive use of arbeiten in the collocation eine Figur arbeiten, which means ‘to model a statue or figure (out of clay or plasticine)’, but this use is only marginal.

20 This verb is hard to translate into English. A typical use of it is in connection with dossiers, e.g. Sie bearbeitete seine Akte (she dealt with his dossier) which could be said of a civil servant (who has to deal, say, with an application for social benefits and who goes through the applicant’s dossier to see whether the application should be granted).
An explicit general formulation will be given in a paper that is in preparation, s. (Kamp and Roßdeutscher 2008).

Literatur


