On times and arguments*

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Abstract

Verbs are traditionally assumed to have an "argument structure", which imposes various constraints on form and meaning of the noun phrases that go with the verb, and an "event structure", which defines certain temporal characteristics of the "event" to which the verb relates. In this paper, I argue that these two structures should be brought together. The verb assigns descriptive properties to one or more arguments at one or more temporal intervals, hence verbs have an "argument-time structure". This argument-time structure as well as the descriptive properties connected to it can be modified by various morphological and syntactic operations. This approach allows a relatively simple analysis of familiar but not well-defined temporal notions such as tense, aspect and Aktionsart. This will be illustrated for English. It will be shown that a few simple morphosyntactic operations on the argument-time structure might account for form and meaning of the perfect, the progressive, the passive and related constructions.

1. Introduction

Ever since its beginnings, research on the expression of temporality in natural languages has centered around three notions, all of which are closely related to the verb — tense, aspect, and Aktionsart[1]. This research has pleased us with many remarkable findings. But it is perhaps fair to state that opinions still vary considerably on how these notions are to be defined and how they work in particular languages. There is no generally accepted analysis of temporal constructions such as the English progressive, the German *Perfekt*, or the Russian aspect, although the literature on each of these constructions is legion. Moreover, there are hardly any attempts to show how the meaning of these constructions follows from the way in which they are built up from their components. In what follows, I will suggest a way to look at time in language, which deviates

considerably from this tradition while trying to preserve the intuitions which guided it. Two assumptions are basic to this approach:

(i)   As a rule, the notion of simple "event time" should be replaced by the more general notion of a "clause-internal temporal structure".
(ii) The arguments of the verb (and other verbal constructions) are temporally parameterized.

The lexical content of a verb assigns descriptive properties to certain arguments at certain times. These times are connected to each other by temporal and possibly other relations. Compound constructions, up to the level of the clause, result from morphological and syntactic operations on this "argument-time structure". Under this approach, traditional notions such as tense, aspect and Aktionsart, but also perfect, progressive or passive, turn out to be special cases of how time spans and temporal relations between them are clustered. These ideas will be unfolded in Sections 2–3 and illustrated for some elementary morphosyntactic operations in English in Sections 4–7.

The aim of this paper is, of course, not to give answers to the many problems that were so intensively discussed in almost two millennia of research on temporality; any such idea would be more than presumptuous. The idea is rather to sketch a new and simple way to approach these problems, a way which systematically derives the meaning of classical temporal categories, such as past participle, perfect, passive or progressive from the manner in which the corresponding expressions are built up. I have therefore focused on the key ideas of this approach; thus, many issues are only sketched, and many details are completely ignored. In a way, the following considerations should primarily be seen as an invitation to follow a certain way which I believe to be promising.

2.   Event time and clause-internal temporal structure

Under its traditional definition, tense is deictic and relational: broadly speaking, it relates the time of the event to the time at which the sentence is uttered. Usually, three possible temporal relations are distinguished: time of event before time of utterance, time of event simultaneous to time of utterance, time of event after time of utterance, thus giving rise to the basic distinction between past, present and future, respectively. This idea is already found in Aristotle and the Stoic philosophers. It is easy to see that it is by far to simple even in the case of Classical Greek, for which it was invented. If there are more than three tense forms, then three deictic-temporal relations are not enough; other factors must be taken into consideration. One possible solution is the introduction of a "third temporal interval", an idea which apparently originated in the late 18th century (Seuren 1998: 73–74) and is then found in the writings of many gram-

marians, most explicitly Hermann Paul in his analysis of the Indo-European tense system (Paul 1886: 228–229; see the discussion in Ehrich 1992: 65). Modern linguists often ascribe it to the philosopher Hans Reichenbach, who operated with three temporal parameters E, S, and R, which he called "point of event", "point of speech" and "point of reference", respectively (Reichenbach 1947). Analyses based on these three parameters have become almost classical over the last fifty years; they have even made their way into pedagogical grammars. But it is easy to show that each of them faces problems that go beyond the concrete difficulties to analyze a particular linguistic system, such as the tense system of English, German, or Russian.

In this paper, I will not address S and R (for a discussion, see, e.g., Kratzer 1978; Hamann 1987; or Klein 1994) but only the "event time". What is this event time? Reichenbach treated it as a point. Most authors nowadays say that it is time span of undefined length — the time at which the "event" takes place, or could take place. Thus, in a simple sentence such as *Caxton left*, it is the time at which the "leaving event" took place. How is this in (1):

(1)   *Caxton seemed to have planned to come at five.*

What is the "event" of (2), and more specifically, what it is the corresponding event time? This is not immediately apparent. Is it the time at which something seems to be the case, is it the time of Caxton's intended leaving, the time at which he planned to do something, the time at which he had planned to do something? What we have here is rather a whole array of time spans, each of which is characterized by one or several descriptive properties. We do not have a single "event time", described by a simple verb, but a complex temporal structure which is described by several components of the clause, in particular various verbal elements. This clause-internal temporal structure consists of several interrelated temporal intervals, one of which (the time at which something seems to be the case) is related to some time beyond the clause — maybe S or R, or some time span provided by a matrix clause. In what follows, I shall simply speak of a "clause-external time", abbreviated as t_{ex}, thus leaving aside for the moment what precisely this temporal anchor is.

In (1), minimally five time spans play a role in this clause-internal temporal structure:

(2) (external) *Caxton   seemed   to have   planned   to leave   at five*
        t_{ex} t_1 t_2 t_3 t_4 t_5

There is a time at which something seems to be the case, there is a time at which someone apparently planned something, there is a time at which possible planning is over, there is a time at which someone apparently had planned to leave, and there is a time specified by "before five". Between these altogether six time spans, there are certain temporal relations:

(a) t_{ex} is after t_1,
(b) t_1 overlaps with t_2,
(c) t_2 is after t_3,
(d) t_3 is before t_4,
(e) t_5 is most likely identical with t_4; but other readings are possible, especially if *at five* is de-stressed.
(f) t_1 overlaps with t_2, and t_2 in turn overlaps with t_4.

Thus, there is not a simple E — there is a complex temporal structure which any analysis of temporality must account for. In particular, the following four questions must be answered:

(3)   (i)   Which intervals constitute the internal temporal structure of the clause?
    (ii)   How are these intervals related to each other? This problem resembles the familiar issue of argument control, except that the relation between the entities that fill the variables is not just "identical" but may also be "before, after, overlapping, simultaneous" etc — in short, all sorts of temporal relations that can obtain between two time spans.
    (iii)   Which temporal properties go with the various intervals? By that, I mean properties such as duration, frequency, or position on the time line. Typically, these properties are specified by various types of adverbials, such as *for an hour, often, or yesterday at five.* They can be inserted at various places, and thus may relate to various time slots in the temporal structure.
    (iv)   Which descriptive properties go with the temporal intervals? In other words, how are these temporal intervals characterized other than being before or after other time spans, or being short or long? In (2) there is a time at which something seems to be the case, a time at which someone apparently plans to do something, etc. This information is primarily provided by the descriptive content of the various verbal elements; it can also stem from other sources, such as world knowledge or situational information — in short, by the context.

Note that a clear distinction is made here between bare "time structure" itself (the temporal intervals and the temporal relations between them), on the one hand, and the "descriptive information" that goes with these intervals, on the other. In (4), for example, the bare time structure would be exactly the same, but the descriptive properties that go with the various intervals are different:

(4)   *Caxton believed to have promised to call before noon.*

Thus, the clause-internal temporal structure has two different ingredients — a distinction which is crucial for the approach that will be proposed here, and which is normally not made in traditional research on temporality.

In (1) and (2) the clause-internal temporal structure is provided by a complex verbal construction, and, somehow, it corresponds to the structural makeup of this construction. How is this, if there is only a simple verb, as in (5)?

(5)   *Wynkyn felled a tree.*

Morphologically, the form *felled* is compound: it merges a finite and a nonfinite component. (The former will be discussed in Section 7). The latter is the "lexical part", also found in the infinitive *to fell*, in the participle *felling* or in the finite form *fells*; this part I will call V_s (for "verb stem"). Does the lexical content of a bare and simple V_s such as *fell* include a complex temporal structure as well? For the situation described by (5) to be true, at least the following conditions must be met. (The descriptive characterizations given below, such as "be upright", are only illustrative; they are not meant to be an exhaustive and satisfactory meaning description):

(6)   (i)   There must be a time t_1 at which Wynkyn does something, for example swinging an ax or maneuvering a chain saw, or utter a magic spell; I will simply say he must somehow "be active".
      (ii)   There must be a time t_2, at which the tree is "upright".
      (iii) There must be a time t_3, at which the tree is "on the ground".
      (iv)   Various temporal relations obtain between these times. Thus, t_3 must be after t_2. The time t_1, the time at which Wynkyn is active, must somehow overlap with t_2, i.e., the time at which the tree is upright; it may reach into t_3, but this is irrelevant for Example (5) to be true.

These four conditions do not cover the full lexical content of *fell*. In particular, there is also a causal, and not just a temporal, connection between the acting of Wynkyn and the fact that eventually, the tree is "on the ground". Following David Hume's famous analysis of causality (Lewis 1973), we can state this connection as a counterfactual condition: "If the first argument were not be active at t_1, the second argument would not be on the ground at t_3." Such a nontemporal relation, often referred to by some operator CAUSE, is an indispensable component of the lexical content of many verbs. But it is not directly relevant to our present concern, and so, I will not discuss it here but focus on the temporal side.

It appears, therefore, that not only compound expressions, such as *seem to have planned to come*, but also bare V_s, such as *fell*, can already provide a rich temporal structure. This brings us to the core assumption of the present approach:

(7)   The lexical content of a verb (or a larger verbal expression) assigns descriptive properties to certain arguments at certain times. These times are connected to each other by temporal and possibly other — for example causal or modal — relations. The lexical content of the verb itself does not specify the arguments nor the time spans; it only provides argument-time variables, which must be filled appropriately in order to obtain an interpretable utterance.

Under this assumption, arguments are *temporally parameterized*: it may well be that a single verb assigns mutually exclusive properties to one and the same argument. This is no contradiction because the assignment is relative to different times. Thus, the direct object, for example, may have a "first time" at which it is assigned property A, and a "second time", at which it is property B, whereas the subject, for example, has only one time, at which is assigned property C by the lexical verb.

Let me state this somewhat more systematically. As any lexical entry, V_s is a cluster of (at least) three types of features — those which constitute its form ("phonological" or "graphematical"), those which constitute its meaning ("semantic") and those which constitute its combinatorial properties ("categorial"). The semantic features of a verb include a *structural component* and a *descriptive component*. The structural component is the "Argument-Time-Structure" (AT-structure) of the verb. It consists of various AT-pairs together with a specification of temporal and nontemporal relations between them; it is a pure scaffold, so to speak. The descriptive component consists of the various descriptive properties that are assigned to these AT-pairs. These two components can be coupled in different ways. They may be conflated into a single morpheme, as is the case with *fell*. In predicative constructions, such as *be alive*, the descriptive property is contributed by *alive*, whereas the copula verb *be* in itself does not specify a descriptive property; it only has an AT-structure, and it can be made finite (in contrast to the other component *alive*). Many other cases are possible, but I will not go into these here. I should point out, however, that much the same point can be made for some other lexical items, such as nouns or adjectives. The adjective *green* assigns a property to some argument at some time, the noun *water* assigns a property to some argument at some time; at some other time, this same argument may have the property of being ice or steam or a supermarket tomato.[2] The difference between nouns and adjectives, on the one hand, and verbs, on the other, lies primarily in their categorial features. Nouns and adjectives cannot directly be made finite, but they admit other morphosyntactic operations; for example, they can be combined with a copula, yielding a construction which then in turn can be made finite. I shall say that verbs are FIN-linkable, whereas nouns and adjectives are not (or rather: only indirectly) FIN-linkable.

A V_s, as a lexical item, is the starting point for a whole series of morphological and syntactic operations, which bring forth various types of compound expressions up to the level of the finite sentence. These operations enrich or modify the underlying AT-structure and its descriptive counterparts in various ways. They may select, for example, a subinterval of some interval given in the AT-structure, as I believe is the case with the English suffix -*ing*, or they may add a "pretime" or a "posttime". They may provide these additional times with some descriptive properties or not, they may also "fill" an argument slot or a time slot, for example *Wynkyn* in Example 5 or *at five* in Example 2, respectively. We shall examine a number of these operations in Sections 5–7.

3. AT-Structure and descriptive properties

3.1. *The basic distinction*

The idea that the lexical content of a verb has a rich internal structure is not new. It is found in traditional lexical semantics (see, for instance, Lyons 1977; Cruse 1989) as well as in a number of more formal approaches (e.g., Dowty 1976; Jackendoff 1991; Pustejowsky 1995; Wunderlich 1997, to mention but a few). Representations such as "x CAUSE (BECOME (y be dead))", where x and y refer to the argument variables, are typical of these latter approaches. The present approach differs from these in two respects. First, it is assumed that arguments are temporally parameterized, i.e., there is not just an x but "x at t_1", "x at t_2" etc. Second, a sharp distinction is made between the AT-structure — the structural skeleton, so to speak — and the descriptive properties which go with the various AT-pairs of this structure. In particular, it is assumed that a morphosyntactic operation can add a new temporal interval without providing some descriptive properties that would go with this additional interval. The English construction *having slept*, for example, relates to a time after a more or less extended sleeping interval; but nothing in the lexical content of *having slept* tells us what is the case at that "posttime": it is a just a time after a sleeping time.[3] Whatever we assume to be the case at the *having-slept* time is due to contextual and world knowledge, on the one hand, and to the usual pragmatic principles of communication.

How do we decide what the argument-time structure of some V_s is? The answer is comparatively simple (but surely not trivial) for the first part — what are the arguments?, and I shall not go into this issue here. But how many times go with a given argument? As with any kind of lexical analysis, there are two ways to proceed when answering that question: we can ask our semantic intuitions, and we can look how the item in question interacts with other expressions. Both ways have their inherent problems, as is well illustrated in the

familiar attempts to determine various types of "Aktionsarten"; their definition is either based on intuitions with respect to properties such as "homogeneity", "duration", and similar ones, or they are based on tests such as the interaction with certain adverbials such as *for two hours* vs. *in two hours* (see Klein 2009b for an extensive discussion). As regards the AT-structure of a verb, we typically have some intuition whether they involve a "change" with respect to some argument or not. Thus, in *The cup stood on the table*, we do not assume a change of the (single) argument *the cup*, whereas in *The cup fell onto the table* or *The cup broke*, there is such a change, in this case a change in position. But this intuition is often vague, and more importantly, it relates to the descriptive properties, rather than to the bare temporal properties itself. Crucial to the AT-structure is not the intuition of whether the content of the verb includes many more or less different subintervals but the fact that some subinterval is accessible to morphological or syntactic operations in the particular language. Just as the argument variable, the time variable which goes with it is a foothold for potential structural processes.

Consider the following sentence:

(8)   *Froben studied Russian for two years*.

Clearly, studying Russian includes many different phases — Froben must learn case endings, syntactic patterns, memorize vocabulary items, and so on and so forth; thus, these two years encompass many activities all of which belong to his studying Russian. So, learning Russian has a number of subintervals, characterized by particular properties. But none of these subintervals seems accessible to a morphosyntactic operation in English, just as the various entities involved, for example the vocabulary items he has learnt, are not accessible to such operations — although they are clearly involved in the meaning of *study Russian;* this expression does not have an argument variable for "vocabulary items". Similarly, the adverbial *for two years* in (8) cannot not pick out a specific, descriptively well-characterized subintervals, and when some other adverbial, such as *many years ago, in Chasan, with mixed feelings* etc, is added, it does not specifically address one of these subintervals. In other words, we must carefully keep apart the descriptive content, one the one hand, and the temporal variables with which this content goes, on the others: the fact that there are subintervals does not mean that they can be addressed by some morphological or syntactical operation.

Suppose a V_s provides two times for an argument. This "two-times argument" can be the only argument, as in *die*, or one of several arguments, as in *kill*. Then, the descriptive properties associated with this argument at the first time and at the second time can differ to varying degrees:

A.   They can be mutually exclusive

This case is illustrated by the only argument of *die* and by the second argument of *kill*: these verbs say that the relevant argument is alive at the first time and dead at the second time.[4]

B.   They may differ in degree

Typical examples are V_s such as *rise, raise, fall, melt.* Their descriptive properties are relational with respect to the two times. If the temperature rose, then this means that there is an accessible interval at which the temperature is higher than at an earlier accessible interval.[5] In some cases, it is assumed that the extreme is reached at one of these times; thus, *the fallen temperature* normally means a temperature which is lower than at the first time, whereas *the fallen leaves*, without any further qualification, is understood to mean leaves which are not only lower than at the first time but are "on the ground". Otherwise, the difference must be specified: *the leaves had fallen by two meters.* I do not think, however, that these preferences in interpretation should be seen as a part of the lexical meaning of *fall*; they are an issue of world knowledge. Otherwise, one would have to assign many meaning shades to the lexical meaning of this verb, depending on which argument it is applied to.

C.   They may be identical

Examples are *stay, remain*, or *keep, as* in *The door remained open* or *Winter kept us warm.* This case sounds perplexing at first; why should a verb involve two intervals with the same descriptive content? But remember that the criterion for assuming an AT-pair is the accessibility to some operation rather than our intuition about homogeneity or heterogeneity. Sentences such as (9a)–(9c) show that it is possible to access a second subinterval only (note that in these examples, descriptive properties and AT-structure are distributed over several words):

(9)   a.   *Gutenberg was forbidden to stay in Strasbourg.*
       b.   *Gutenberg did not stay in Strasbourg*
       c.   *Gutenberg had almost stayed in Strasbourg.*

The lexical content of *stay in Strasbourg* provides a first time with descriptive properties "be in Strasbourg" and a later time with the same descriptive properties "be in Strasbourg". The interdiction *was forbidden* in (9a) only relates to this later time, rather than to the entire time of his being in Strasbourg. In (9b), it is not negated that he was in Strasbourg at some time but that he was not there at some later time, at which he could have been there, too; this applies analogously for the counterfactuality in (9b): *almost* "weakly negates" his being in Strasbourg only for the later time.[6]

As any lexical analysis, the precise determination of the AT-structure which some verb (or larger verbal construction) is a very difficult issue, which I

cannot pursue here.[7] But I hope the general idea is sufficiently clear from this brief discussion. Let me conclude it with two remarks. First, I believe that the missing separation of these two components has been the source of numerous problems with the familiar event type classifications. Thus, verbs of the *die* type are traditionally considered to be "telic". But what about verbs which involve a gradual change, such as *rise* of *fall*? Are they "telic" or "atelic" (as in Garey's [1957] terminology), are they "accomplishments" or "activities" (as in Vendler [1957])? In a way, they behave like activities, as is illustrated by the fact that they can take a durational adverbial: *the shares rose for two days*. But as was first noted by Fabricius-Hansen (1980), sentences such as *Then, the shares fell again* show the repetitive-restitutive ambiguity of *again* which is characteristic of telic verbs. Thus, it is possible to modify only the second time — the time at which the shares were "higher than before" — by an adverbial. Hence, they behave like accomplishments. Under the present analysis, this behavior is predicted.

    The second point is methodological and not specific to the present approach. Ideally, lexical items as well as morphosyntactical operations should always make the same meaning contribution. But natural languages are not like that. They are products of historical development. Expressions, be they simple or compound, can be *ambiguous*, they can be *idiomatized*, and they can exhibit *idiosyncratic properties*. A verb such as *to open* can have a one-argument structure as well as a two-arguments structure. Similarly, we may expect that there is a one-time reading for an argument as well as a two-times reading. On the morphosyntactical level, one might hope that the attachment of, for example, *be* to another word has always the same effect. But we must be prepared that there are exceptions. All we can hope is that our analysis reduces the number of ambiguities, idiomatic cases, and idiosyncrasies as much as possible.

3.2.   *Some examples from English*

In this section, I will illustrate the general idea with some examples from English.[8] Let us begin with the "skeleton", that is, the bare AT-structure, and only then turn to descriptive properties which go with this structure. Theoretically, there is no limit to the number of arguments or of temporal intervals coupled with an argument. In actual fact, however, languages seem to impose severe restrictions on their verbs. I was not able to find cases which convincingly show that a single argument can be accessed at more than two times, although nothing excludes this in principle, just as nothing seems to exclude verbs with ten or twelve arguments. Since this exposition is only illustrative anyway, I will assume here that English has only "one-time arguments" and "two-times arguments". In the latter case, these two times will be called "source time" and

"target time". Note, however, that the difference is only temporal: the source time is just earlier than the target time. Nothing is said about whether the two times are adjacent.

How many arguments can a V_s have? Again, this is difficult to answer; in English, one or two are the most common cases; three is not infrequent; four is almost excluded. In what follows, I will confine the discussion to the most common cases, that is, verbs with one or two arguments. In English, we seem to have the following four patterns:

(10)   Common AT-structures of English
   Type A. One argument at one time: typical examples are *sleep, dance, vibrate*, *be*.
   Type B. One argument with source time and target time: typical examples are *die,* (intransitive) *drown, rise, remain.*
   Type C. Two arguments at the same time: typical examples are *cost, weigh* with a measure phrase.
   Type D. Two arguments — one at one time, one with source and target time: in this case, the time of the one-time argument overlaps the source time of the other argument. Typical examples are *leave, close, slay*, (transitive) *drown, observe.*

Many other patterns are imaginable. For instance, we could have a variant of type C, in which the two time variables are not identical. We might have a pattern with two arguments and two times for each of them. Finally, we might have variants of type D with quite different temporal relations; for example, it could be that only time of the first argument should precede the source time of the other, or overlaps the target time, rather than its source time. I was not able to find such a verb, when going through various morphosyntactic operations that can apply to verb stems. So, I will assume for the moment that English distinguishes only these four AT-structures. This is sufficient for present purposes.

By and large, types A and C correspond to the traditional notion of atelic verbs, whereas types B and D are telic. Note, however, that the distinction made here is exclusively based on the inherent AT-structure, whereas the traditional distinction merges temporal and descriptive properties. Many English verb stems, such as *melt, close, drown* are ambiguous between type C and type D: they must have a two-times argument, and they can, but need not, have a one-time argument. In the latter case, the single-time argument most often goes with the descriptive property "be active". Therefore, the two-times argument is prototypically a "change-of-state argument", whereas the one-time argument is prototypically an "agent" (cf. Dowty 1991).

Let us now turn to the descriptive properties that can go with these structures. Now, a satisfactory analysis of lexical meaning is perhaps the most

difficult task in linguistics. The main reason is the lack of an appropriate descriptive language for lexical meaning. How should we describe the target time properties of the second argument of *leave* in *He left the room, he left many traces, he left his children*, if not by the past participle *left*? Therefore, no attempt will be made here to give a satisfactory analysis of the full lexical content of English verbs. I will confine the discussion to two general comments.

The first of these concerns the difference between "homogeneous" and "heterogeneous" intervals. It was argued above that the situation described by *Froben studied Russian for two years* is in many ways heterogeneous; it contains numerous subphases with different descriptive properties. None of these, however, is accessible to a morphosyntactic operation.[9] But independent of what is needed for the AT-structure, we might wish to differentiate between intuitively homogeneous intervals from intuitively heterogeneous intervals. Such distinctions play an important role in traditional Aktionsart classifications, as reflected in the opposition between "states" and "activities". It is not clear whether such a distinction has a reflex in morphosyntax. It has often been argued that "statives" in English cannot take the progressive form; in fact, this is one of the standard Vendler tests. But this argument is shaky, since many intuitively stative V_s can be in the progressive (*It was hanging on the wall, the cup was containing water, we were hoping for a better future*). I believe, therefore, that this restriction, confined to a verbs such as *know, understand* and a few others, is essentially a remnant of historical development (König 1980; Denison 1993: 371–410). This, however, is not to deny in general, that the difference between intervals for which each subinterval exhibits the same descriptive properties, and those for which this need not be the case, may play a role in grammar.

The second comment relates to the descriptive property "be active". This feature is apparently never associated with a target time, be it of the first or of the second argument; but it is very frequently associated with a first AT-pair. This may be due to the fact that the actor's being active initiates the entire event (I owe this idea to Dieter Wunderlich p.c.). Whenever the feature "be active" is present, other descriptive features may be present, too. Thus, not any kind of activity on Wynkyn's part would qualify in (5). But these additional qualifications are hard to pin down. We often hear that Louis XIV *built* Versailles. In fact, he did not lift a single stone. We say that an architect *built* a house, or that a mason *built* a house. But all they share is that they are somehow active, and that without this activity, this house would not have come into existence. This fuzziness of the "be active" feature may have consequences for more complex constructions. Consider, for example, a sentence as (11).

(11)   *We are leaving Riva tomorrow*.

Under the traditional analysis, (11) seems contradictory: the present tense marks the "event" as being right now, whereas the adverbial marks it as being

tomorrow. Under the present analysis, *leave* involves three time spans — a time at which the first argument is somehow "active", and two times for the second argument (a time at which Riva is not left by us, and a time, at which it is). How is "active" to be understood? Does it necessarily involve some movement? Or is it enough to have taken the first preparatory steps, perhaps even to have made the appropriate plans? I think the latter is the case, and intuitively, this is the impression suggested by (11) (see Williams [2002], who discusses numerous examples of this sort). If this is correct, there is no contradiction whatsoever: (11) simply means that the moment of speech (or whatever the external time is) is included in the first and only time of the first argument of *leave*, AND tomorrow must include subintervals in which we are "active" AND we are first in Riva and then out of Riva.[10]

3.3. *Event time redefined*

Example (11) has brought us back to the issue of "event time", discussed in Section 2. All verb stems have a temporal structure that is hooked up to some external time, when the verb is made finite. This temporal structure may consist of a single interval, if there is only one AT-pair, as in *sleep* or *laugh*. Then, the temporal structure coincides with the classical notion of "event time". But we can extend the notion of event time to more complex cases, such as *leave*, if we consider a larger interval which includes subinterval of all components of *leave*:

(12)   The event time associated with a verb V is a temporal interval which includes subintervals of all temporal intervals provided by V.

Thus, the event time of *Wynkyn felled a tree* is an interval which includes three subintervals: some "be-active time" of Wynkyn, some time at which the tree was upright, and some time at which it was on the ground. Thus, each accessible stage of the whole "event" is represented in this event time. This definition also captures, as a special case, verbal expressions like *sleep*, which provide only one AT-pair; the event time of sleep is a time span which includes a sleeping interval of its only argument. The notion of event time, as defined here, is "duration indefinite", i.e., it can be longer or shorter, provided it contains the required subintervals. Assumptions on its duration in a given utterance depend on context. If the temporal structure is not simple, then there is often a tendency to consider the shortest interval with the required properties as event time. This leads to the impression that verbs such as *to find*, are "punctual", since the minimal interval which includes subintervals of all relevant intervals is very short. But this is wrong; it may easily take someone a whole afternoon to find a kilo of mushrooms. And it should be noted that the "time of

finding" is not the — perhaps very short — time at which the last mushroom is found. This would be the time of finding the last mushroom, not the time of finding a kilo of mushrooms. In other words, to find is not "punctual", because finding something has no temporal extension. It is punctual, because the minimal interval which includes subintervals of all intervals provided by its lexical content can be extremely short.

The definition in (11) can be extended to still more complex temporal structures, such as the one of *seem to have planned to come at five*, which does not describe a single clearly shaped event but a aggregation of events. Such a broad notion, however, seems not very useful. More sensible are perhaps intermediate notions of event time. Thus, we may say that *Wynkyn was felling a tree* has, as its event time, the subinterval in which Wynkyn was active with his axe — no matter whether the tree eventually fell or not. It is a practical question whether such a notion of event time, on whatever level of complexity, is needed. I believe that it could useful for the simple verb, for example in the analysis of the "perfect" (cf. Section 6); but at present, I see no use for other, more complex notions of event time.

4.   Morphosyntactic operations on the argument-time structure

Let me begin with some standard assumptions. Lexical entries such as *leave*, *fall* or *sleep* are clusters of three types of features — phonological features, semantic features, and categorial features (such as "is a noun", "belongs to inflectional paradigm 17", etc). These feature sets are the starting point for various operations which turn a lexical entry into a more complex expression. Operations can be morphological, i.e., within word boundaries, and they can be syntactic, i.e., go beyond the boundaries of a word. They change or maintain the three types of features in a characteristic way; they may also serve to integrate the complex expression into the context.

All operations take some expression and turn it into a new expression by changing some of its phonological, categorial and semantic features. Under the present approach, essentially two types of operations come into play here. Firstly, there are operations that fill the argument variables and the temporal variables, e.g., by an NP in the former case or by a temporal adverbial in the latter. Secondly, there are operations which do not fill some existing variables but somehow modify the descriptive properties, the AT-structure, or both. In the present context, we are primarily interested in this second type of operations (but see Section 7 on the grammatical subject).[11]

Consider a verb stem such as *sleep*, which has only one AT-pair, abbreviated here as $<A, t_i>$, where A is the argument variable and t_i the variable for the time at which the property of being asleep is assigned to A. Operations can change

this elementary AT-structure. Let us first examine the temporal side. Since t_i is an temporal interval, there are, due to the very nature of time, also intervals before t_i, there are intervals within t_i, and there are intervals after t_i; we may call these *pretimes* of t_i, *subtimes* of t_i, and *posttimes* of t_i, respectively (see Note 3). Operations on *sleep* can assign one of these intervals to t_i, which is then accessible to further operations. I shall simply say that they add a subtime, a pretime, or a posttime. It is also imaginable that such an operation adds a somewhat more complex interval, for example an interval which overlaps t_i and the time after t_i. The crucial point is always that an additional temporal interval is henceforth available for further morphological or syntactic operations.

Whenever the existing AT-structure is enriched in this way, descriptive properties can but need not be added, as well. Thus, German *los-*, as in *losrennen* "to start running", adds an pretime, about which nothing is said except that it is not yet a running time, and English *-ing*, as in *sleeping*, adds a subtime, which preserves the descriptive information of t_1. There are also syntactic operations which serve this function, for example phase verbs such as *to begin to;* whereas *John slept* involves one time, *John began two sleep* involves two times — a time at which John indeed was asleep, and an earlier time about which nothing is said except that it is not a sleeping time (of John). The addition of *plan to*, as in *to plan to sleep*, not only adds an accessible "pretime" but also characterizes this pretime as a "planning time".

Turning now to the argument side of operations on the AT-structure, the simplest case is surely that the argument variable is maintained. Thus, *losrennen* has the same argument variable as *rennen* "to run"; *to be going to sleep* or *to plan to sleep* have the same argument variable as the underlying V_s *sleep*. There are other possibilities, as in *to seem to sleep*, as has been extensively studied in work on argument control; but I shall not go into these here. There is an important consequence of adding such a pretime for the same argument: the argument is then interpretable at several times — for example at the sleeping time itself as well as at some pretime of the sleeping time. In other words, we have what was called above "temporally parameterized arguments". In this case, the parameterization is not part of the V_s but results from the morphological operation. Since the argument variable is usually filled only once, for example by the grammatical subject, this raises the question at which time this grammatical subject is interpreted — is it interpreted at the "topmost time", i.e., by the one added by the operation, or at some embedded time? This becomes important as soon as the entire temporal structure of the clause is related to some clause-external time, for example the moment of speech. We shall come back to this question in Section 7.

A verb stem like *sleep* provides only one AT-pair. What happens, if some operation is applied to a V_s with several AT-pairs, such as *fell*? Then, either one of them must be selected, or else the operation works simultaneously on

several of them. This varies from operation to operation and has to be marked specifically in the definition of this operation. A common case, for example, is that the first argument at its first (and perhaps only) time is targeted. Thus, the operation which turns bare *fell* into *felling* provides a subinterval of the time at which the first argument "is active" — whatever precisely this activity may consist of. This time overlaps with the source time of the second argument, but it need not overlap with the target time of the second argument (see (6iv) above).

The net effect of AT-operations is to provide an additional AT-pair, with or without additional descriptive content. This means that the new pair is now available for further morphosyntactic operations. This process can be repeated, up to the construction of a finite clause and — as in subordinate clauses — even beyond. Example (2) *Caxton seemed to have planned to leave at five* illustrates such a chain of operations, which leads from the V_s *leave* to the finiteness marking by *-ed* on *seem*. Since the formation of such a chain is stepwise, it seems natural to assume that each operation applies to the AT-pair brought about by the immediately preceding operation. This last-added pair — the topmost pair in a complex construction — I shall call the "active pair".[12] In principle, however, it is not excluded, that other, "enshrined" AT-pairs are still accessible. This may vary from operation to operation; it may also be different for argument variables and for time variables.

5.   Three morphological operations in English

We shall now illustrate this with some examples from English. The starting point is the bare verb stem V_s. In principle, all operations discussed in the following affect phonological, categorial and semantic features. But in the present context, we are mainly interested in their effect on the AT-structure and the accompanying descriptive properties. Therefore, the phonological and the categorial side will only be briefly dealt with; in fact, most changes are straightforward. In general, it should be clear that the discussion in this section cannot claim to cover all problems connected to form and function of these constructions; the idea is rather to illustrate how the idea of an argument-time structure and various operations on this structure yield a new and, in the event, surprisingly simple picture of what is traditionally described under labels such as, for example, past participle.

5.1.   *V_s-Ø: the "bare infinitive"*

In English, the bare infinitive is phonologically identical with V_s (in contrast, for example to Dutch or German, where *-en* is attached to V_s). As to the cate-

gorical features, the main change is that the resulting structure is no longer
FIN-linkable. There is no reason to assume that this operation changes the AT-
structure or the descriptive properties.

5.2. V_s-ing: the "present participle"

This form is usually assigned several functions, sometimes kept apart by labels
such as "present participle" vs. "gerund". I assume that this distinction, if re-
ally needed, only concerns categorial features, in which we are not primarily
interested here; the main change in this regard is again, that V_s-*ing* is no longer
FIN-linkable. As to the phonological features, the effect is simple: -*ing* is
attached.

   How does the attachment of -*ing* affect the AT-structure? This is best seen in
cases, in which no other operation interferes. In the finite progressive *John was
working*, for example, not only the -*ing*-marking, but also *be* and the finiteness
marking on it contribute to the entire meaning; it is not easy to tell these con-
tributions apart. In attributive constructions such as *the sleeping dog* or *the
falling snow*, we observe the effect of bare -*ing*. Intuitively, these constructions
give the impression that the argument, to which the present participle is at-
tached, is somehow "in the midst of the event". We can capture this intuition
by assuming that -*ing* adds, as an accessible interval, a subtime of the first (and
possibly only) time of Vs. In the case of *sleep*, there is only one such interval
(type A in 10); hence, *sleeping* relates to a proper subinterval of a sleeping inter-
val; in terms of descriptive properties, this subinterval is also a sleeping inter-
val. In the case of intransitive *drown* — type B in (10) —, the form *drowning*
gives us a subtime of the source time of the only argument — roughly charac-
terized by properties "not yet dead, under water". When derived from transi-
tive *drown* (type D in (10), the form *drowning* gives us a subtime of the first
argument — a subtime of the time at which the subject "is active"; this time
overlaps with the time at which the other argument has its first-time properties,
i.e., roughly "not yet dead, under water". In both cases, *drowning* does not
imply that the event is completed in the sense that the subject (in the intransi-
tive case) or the object (in the transitive case) is dead.

   We can sum up the effect of this operation as follows. Phonologically, it
adds -*ing* to V_s. Categorially, the resulting expression cannot directly be made
finite. Semantically, it adds a new AT-pair, such that

   (a)   the argument is the first (and possibly only) argument of V_s, and
   (b)   the time is a subtime of the first (and possibly only) time of that
         argument.

In other words, the English *-ing*-construction places the argument to which the present participle is applied somewhere "in the midst of the event" — and exactly this is our intuition.

5.3. V_s-ed*: the "past participle"*

English has two suffixes *-ed*, one of which results in a finite form (simple past of regular verbs) and the other one in what is traditionally called the past participle. Here, we are interested in the operation which leads to the latter (for the former, see Section 7). Its consequences for the phonological features vary; in the simplest case, the suffix *-ed* is attached to the stem; but there are, of course, many irregular forms, not to be discussed here. There are changes in the categorial features; in particular, the resulting form is no longer FIN-linkable.

As the contrast between *the falling snow* and *the fallen snow* shows, *-ed* relates the argument *the snow* to the second, rather than to the first, time of the only argument of *fall*. This is also the case in *the killed soldier*, except that *kill* has two argument slots — it belongs to type D from (10). Only one of these arguments has two times; thus, *killed* describes what is the case with the two-times argument at its second time: roughly, being dead after being alive, and this due to some activity of the other argument.

What happens if V_s does not provide such a second time, as in *sleep* or *laugh*? They have only one argument at one time. Then, the attachment of *-ed* should not lead to a construction that is able to assign properties to an argument. This is indeed the case — we cannot say *the slept dog* or *the laughed waiter*. This presupposes that *-ed* itself does not add a new argument slot at some later time: it only adds a new time variable, which must be the second time of an argument — a target time.[13]

The effect of this operation can thus be summed up as follows. Phonologically, it adds *-ed* to V_s (barring a number of irregular forms). Categorially, the resulting expression cannot directly be made finite. Semantically, it does not add a new argument variable, but it adds a new time — the target time of the first or second argument.

In this section, we have examined three simple morphological operations on V_s. On the phonological level, their effect is to add Ø, *-ing* and *-ed* (with some irregular variants), respectively. On the categorial level, their main effect is to turn a FIN-linkable expression into a non-FIN-linkable expression. On the semantic level, they all change the AT-structure, but not the descriptive properties. Ø adds nothing; *-ing* adds a subtime to the time of the first (and possibly only) AT-pair; *-ed* provides no argument variable; but if V_s provides a target time for some argument, then this target time is the new active time. In other words, these operations are essentially calculations on temporal structures —

they do not add any new descriptive content. But they may apply the descriptive content provided by the verb stem at different times than before.

This is a very simple analysis. It does not stipulate semantic ambiguities, it is in agreement with the empirical facts; it explains why attributive constructions with intransitive V_s such as *slept* are impossible, whereas attributive constructions derived from intransitive V_s, such as *fallen* or (intransitive) *drowned,* are possible — barring other restrictions. The resulting constructions are accessible to several other operations, which act on the new active AT-pair. We shall now have a look at three of these operations.

6.   Three elementary syntactic operations in English

The operations discussed in this section lead to the constructions which are traditionally called (nonfinite) "progressive", "perfect", and "passive", respectively. As we shall see, most properties of these constructions follow naturally from some simple assumptions about AT-structure.

On the phonological level and on the categorial level, the three operations are very similar: some element is juxtaposed before V_s-*ing* or V_s-*ed*, and the resulting construction is made FIN-linkable. In what follows, I shall therefore focus on the semantic side.

6.1.   Be *V_s-ing: the (nonfinite) progressive*

Semantically, this operation simply maintains the active AT-pair; the effect is merely on the categorial level: *be closing* assigns descriptive properties of the first subtime of *close* — the "activity time", so to speak — to some argument (which, when the construction is made finite, can be filled by the grammatical subject). In other words, the effect of this operation is exactly the same which turns *green* into *be green*, and *a teacher* into *be a teacher*.

6.2.   Be *V_s-ed: the (nonfinite) passive*

The simplest assumption is, that here, too, *be* functions like a normal copula: it maintains the active AT-pair. Differences only result from the fact that the active pair of V_s-*ed* is different from the active pair of V_s-*ing*. A past participle such as *closed* assigns target time properties to its argument — if there is an argument slot at all, i.e., if the underlying V_s has a two-times argument (see Section 5.3). This is the case for transitive *close*, and therefore, *be closed* assigns target time properties to an argument, when this argument is syntactically realized. It is not the case for verbs such as *sleep*. Therefore, *The dog is slept* should not be possible, and it isn't.

This analysis naturally explains the static but not the dynamic reading of the English *be*-passive: for *The egg was boiled,* it says that at some time in the past, the egg had the target-time properties of *boil-.* But this sentence can also mean that within a time in the past, the egg had first the source time properties of the second argument of *boil-* (somehow exposed to water, but raw) and then the target time properties of *boil-* (i.e., be boiled). In this regard, the dynamic *be*-passive in English deviates from all other *be*-constructions — *be green, be a teacher, be in Riva, be sleeping.* It also deviates from other West-Germanic languages such as Dutch or German, in which the static reading is expressed by the immediate counterpart of *be,* and the dynamic reading by a "change-state copula" (*worden* in Dutch, *werden* in German). Such a copula also existed in Old English; but it was abandoned and replaced by *become* and, to some extent, by *get* in predicative constructions. In the "passive", i.e., in combination with a past participle, it was replaced by *be* or by *get*.[14] This historical development has led to a system with smaller irregularities, and this renders a coherent analysis of the meaning contribution of *be* difficult: we have the usual static *be* for all types of uses and a dynamic *be*, that is only found in the dynamic reading of the "passive".

In the present framework, the static and the dynamic reading of *be* V$_s$-*ed* differ in that the static reading just picks out the time of the active AT-pair, whereas the dynamic *be* V$_s$-*ed* picks out this time and a pretime of it. Thus, *be* adds an AT-pair which has the same argument as the active pair and a new time which is (a) the time of the active pair OR (b) the time of the active pair and a pretime of it. In the latter case, it includes the transition from pretime to active time, and this yields the dynamic reading. Now, *be green, be a teacher, be sleeping* cannot have a dynamic reading, whereas *be boiled* can. The dynamic reading is only possible, if the pretime is a source time — that is, the first time of a two-times argument; *green, a teacher, sleeping* do not provide a source time, whereas *boil* does.

We can now describe the effect of attaching *be* in all usages as follows. Phonologically, it is juxtaposed to the left of the expression to which it applies. Syntactically, it makes the resulting expression FIN-linkable. Semantically, it adds a new AT-pair such that

(a)   the new active argument is the same as the old active argument,
(b)   the new active time is the old active time OR optionally the old active time and its pretime, if this pretime is a source time.

This is less elegant than to say that *be* only makes the expression FIN-linkable, and thus changes its morphosyntactical properties; but just as historical development often leads to and wipes out certain irregularities, it also may lead to and wipe out ambiguities.

This immediately brings us to the second problem, also connected to historical development. Under the present analysis, it should be regularly possible to have constructions such as *The snow is fallen*, *the pope is died*, because the underlying intransitive V_s, and thus the resulting participle, provides an appropriate AT-pair. In the static reading, these constructions were common in Old English, but in contrast to other West-Germanic languages (Shannon 1989), they are marginal in modern English (see Elsness 1997: 237–272 for a detailed account of this development). The dynamic reading never evolved. In both cases, this may be due to a competition. In the static reading, there was a competition with *the snow has fallen, the pope has died*, which, as we shall see below, yields virtually the same meaning. In the dynamic reading, a construction such as *the snow is fallen, the pope is died* would mean the same as the *snow fell, the pope died,* and therefore, it never evolved.

6.3.   Have V_s-ed*: The (nonfinite) perfect*

There has been considerable discussion on the semantics of the English perfect (see, for example, Comrie 1976: 56–61; McCoard 1978; Fenn 1987; Elsness 1997; Iatriou et al. 2001; Katz 2003). Note, however, that we are talking here about the nonfinite perfect, that is, forms such as *have slept*, *have fallen, have left*. For these expressions, an analysis in terms of an "extended now" or of "current relevance", as often advocated in the literature, does not make much sense: there is no moment of speech, nor any other clause-external time, to which they are linked. Intuitively, all of these expressions relate to a time after a time with the descriptive properties provided by V_s *sleep, fall, leave*, respectively. In other words, they add a posttime, and they do not say anything about the descriptive properties which are assigned to any argument at this posttime.

We can thus describe the effect of *have* as follows. Phonologically, it is juxtaposed to the left of the expression to which it applies. Syntactically, it makes the resulting expression FIN-linkable. Semantically, it adds a new AT-pair such that

(a)   the new active argument is the first (and possibly only) argument of V_s,
(b)   the new active time is a time after a time which overlaps with all subintervals provided by V_s.

In *have slept*, the new time is a time after some interval at which someone has the properties *sleep*, and the new argument is the same as the old argument (but it need not have the "sleep properties" at that later time!). In *have fallen*, the posttime is after some interval in which the relevant argument was first higher, then lower. In *have left*, the posttime must be after an interval which includes (a) the time of some activity of the first argument, which is taken over into the

new AT-pair, and (b) the source time as well as the target time of some other argument. In neither case does the operation itself say anything about the descriptive properties of the argument of *have* at the posttime. If the temperature is assigned the property *to have fallen*, then it must have gone from "higher" to "lower". But it is not excluded that it has risen again. The only exception are verbs whose target time is considered to last forever — such as in *have died*.

We conclude this section with a brief look at combined operations with *be* and *have*.

6.4.   Have been V_s-ing: *the perfect progressive*

Consider sentence (13):

(13)   *Fust had been cooking a pea soup (when the stove exploded)*

It means that at some time in the past, Fust was in the posttime of some x-interval. This x-interval is a "*be-cooking* time"; it is the time at which Fust is somehow active, putting the pot on the stove, pouring water and peas into it, or whatever else might belong to this activity. It need not, but can, overlap the time at which the soup is ready, of course. In this particular example the "non-completed" reading is more likely: we assume that he is still in the midst of his soup making, when he is so unpleasantly interrupted.

What is the meaning contribution of *have been cooking* to (13)? Let us look at the various steps that bring forth this expression:

- V_s *cook*: it is a verb of type D, includes three AT-pairs, one for the first argument ("Fust") and two for the second argument ("pea soup")
- *-ing* added: selects a subtime of the first AT-pair (Fust's activity)
- *be* added: *keeps* the AT-structure, makes the expression FIN-linkable
- *-ed* added: adds a posttime (but no argument slot) to the active AT-pair, i.e., it creates a time after a "be-active with cooking" time
- *have* added: adds an AT-pair with an argument of *be cooking* and a time after *be cooking*-interval; makes the expression FIN-linkable.

In other words, the meaning of the (nonfinite) perfect progressive follows step by step from the various morphological and syntactic operations we have assumed so far.

7.   Finite constructions

The constructions we have derived so far are all nonfinite but FIN-linkable, that is, they can directly be made finite. This requires a morphological as well as a syntactical operation:

(a)   the topmost FIN-linkable element must be marked as finite, and

(b)   one of the arguments must be filled appropriately by a (possibly pho-
      nologically empty) NP, the grammatical subject.

In what follows, I will discuss these two operations in turn (for a more detailed
discussion of finiteness, see Klein [2006]).

7.1.   FIN-*marking on the verb*

FIN-marking, too, is an operation on phonological, categorial and semantic fea-
tures of the element to which it is applied; this is the topmost verbal element of
the entire nonfinite expression. Here, we shall only deal with the semantic side.
In that regard, FIN-marking has three effects:

1.   It adds a new interval, let us call it t_{fin} for the moment,
2.   it relates t_{fin} to the external time — it "anchors the sentence in time", so
     to speak, and
3.   it somehow characterizes t_{fin}.

The fact that FIN-marking adds a new accessible time t_{fin} is best illustrated by
examples like (14):

(14)   *Why did Göschen not come to the meeting yesterday? — He was ill.*

The assertion made by *He was ill* does not target the full time span provided by
be ill. Göschen could still be ill at the moment of speech; in *He was dead*, this
is almost certainly the case. For (14) to be true, it is only required that there is
some time which (a) is in the past and (b) includes some time at which he is ill:
it is this time about which the assertion is made. This is the "finiteness time"
t_{fin}. Note that t_{fin} can be a subinterval of his being ill, but also a superinterval of
his being ill: in both cases, t_{fin} includes a subinterval at which he is ill.

  We can naturally extend this idea to verbal expressions with more than one
AT-pair:

(15)   FIN-marking on some FIN-linkable V adds a new time t_{fin} which
       includes subtimes of all the time spans provided by V.

FIN-marking always applies to the topmost V of some construction. The tem-
poral relationship between t_{fin} and other time spans within the entire verbal
construction depends on the way in which this construction is built up. When,
for example, the construction *be cooking* is made finite, as in *Unger was cook-
ing*, then a subtime of the FIRST interval of *cook* is selected as t_{fin} — the "be
active"-time of the first argument. This results from the various operations
discussed in Sections 5 and 6. Under this analysis, the bare verb stem *cook*
(type D) includes three times, one for the first and two for the second argument.

The present participle *cooking* selects a subinterval of the only time of the first argument, *be cooking* maintains this time and the argument and makes the construction FIN-linkable. When *cook* is directly made finite, then an interval which contains subintervals of all intervals provided by *cook* is selected as t_{fin}. This leads to the impression that *Unger was cooking a pea soup* is already true when he was putting the peas into the water etc.: Unger is, so to speak, "in the midst of the action", the event is presented as ongoing, as the traditional terminology has it. In *Unger cooked a pea soup*, however, there must be a time in the past within which (a) he did that, and (b) there was first no pea soup and then, due to his efforts, there was a pea soup. In other words, all subintervals must be (partly) included in t_{fin} — in the time about which the assertion is made: the "event is presented as completed". In other words, our analysis naturally leads to the perfective-imperfective difference between the English simple form and the progressive form.

The resulting t_{fin} is then related to the clause-external time, for example the moment of speech, or the time of some higher verb (cf. Section 2). English provides three possibilities here:

(16) (a)   The external time is a subtime of t_{fin} (= present tense).
     (b)   The external time is a posttime of t_{fin} (= past tense).
     (c)   The external time is a pretime of t_{fin} (= future tense)

So far, t_{fin} is just another time span. Which descriptive content, if any, goes with it?[15] In Examples (14) and (16), it is the time to which the assertion made by the utterance is confined. This characterization does not work for sentences which do not make an assertion. But we can naturally extend it to clauses which have a different function. Generally speaking, t_{fin} goes with the functional properties of the clause whose topmost internal time it is. Thus, if this clause is declarative, such as *Göschen was ill*, then t_{fin} is indeed the time to which the assertion is confined. If this clause is an imperative, such as *Close this window!*, then t_{fin} is the time, at which the obligation is meant to hold. If it is a subordinate clause, then the interpretation of t_{fin} varies with the type of this clause; in temporal clauses, for example, it may be just the time during, before or after which something is the case (*while/before/after Koberger had been sleeping*). Hence, there is no uniform function. As an overarching expression, which is not directly bound to the language-specific device of finiteness marking, I shall use the term "topic time" introduced in Klein 1994.

7.2.   *Grammatical subject*

Nonfinite expressions, such as *leave, have left, have been leaving*, include a more or less complex AT-structure with several time variables and several ar-

gument variables. In particular, one and the same argument variable may be coupled with different times: arguments are temporally parameterized. When such an expression is turned into a finite clause, one of its arguments is realized as the grammatical subject, i.e., by a noun phrase with particular categorial and phonological features, such as position or nominative case. From which AT-pair is the relevant argument chosen? The first part of the answer is simple:

(17)   The first (and possibly only) argument of the topmost verbal element is realized as grammatical subject.

But since arguments are temporally parameterized, this very argument may be coupled with different times within a complex construction. The most natural assumption is surely that the grammatical subject always goes with the time of the topmost verbal element. In *Wynkyn has felled a tree*, Wynkyn is said to have right now (*has*!) the *have-felled-a-tree*-properties. Thus, the argument realized as grammatical subject is interpreted at the topmost time.

   I assume that this is always the case in English. Other languages, however, may go for different options. In German, for instance, the grammatical subject is chosen in the same way; but there is reason to assume that it can also be interpreted at an embedded position: it need not be interpreted at the topmost time. Compare (18a) and (18b), uttered on May 8, 1998:

(18)   a.   *Gutenberg has left Strasbourg*.
       b.   *Gutenberg hat Straßburg verlassen*.

In English as well as in German, the topmost AT-pair comes from the auxiliary *has*/*hat*. It provides the topic time, which includes the moment of speech (according to 16a), and the argument slot is filled by *Gutenberg*. In English, this argument necessarily acquires the posttime properties of *leave Strasbourg*: as a consequence, Gutenberg is said to be in the posttime of leaving Strasbourg "right now". This does not make much sense if Gutenberg is dead right now (and if the interlocutors know this); therefore, (18a) should be odd, and so it is.[16] In German, this odd reading is possible, as well. But there is a second reading, under which Gutenberg, when referred to by the grammatical subject, is assigned the properties of *leave Strasbourg*, rather than of *have left Strasbourg*. Then, the sentence means something like: "the moment of speech falls into a time after a time at which Gutenberg leaves Strasbourg". This reading is practically identical to the simple past. Therefore, the German perfect can have a "present perfect reading" and a "simple past reading", and this is what is generally assumed in the literature on the German perfect (see, e.g., Wunderlich 1970; Fabricius-Hansen 1986; Thieroff 1992; von Stechow 1999; Musan 2002).

   Thus, the English perfect and the German perfect have the same composition; the difference results from the fact that in German, the "grammatical

subject" need not be interpreted at the "topmost level", i.e., at the topic time. This difference is not specific to the interpretation of the subject. A temporal adverbial in initial position in German need not be interpreted as specifying the topic time. Thus, the sentence *1448 hatte er Straßburg verlassen* can mean that his leaving occurred in 1448, but also that in 1448, he was no longer in Strasbourg. The corresponding English sentence *In 1448 he had left Strasbourg* normally has only the latter reading, that is, the reading in which the adverbial specifies the topic time rather than the "event time".

8.   Perfect, progressive, passive reanalyzed

In this section, we shall illustrate how the present analysis accounts for various finite English forms, in particular the finite perfect, the finite progressive and the finite passive. The first group of examples is based on V_s with one AT-pair only:

(19)   a.   *Grüninger slept.*
     b.   *Grüninger was sleeping*
     c.   *Grüninger has slept.*
     d.   *Grüninger had slept.*
     e.   *Grüninger had been sleeping.*

In (19a) the topic time is before the external time, and it (properly or improperly) includes some of Grüninger's *sleep*-time. In (19b), the topic time is before the external time, too, but the topmost time — the *be-sleeping*-time — is explicitly marked as a subtime of *sleep*. This an impression of being in the midst of sleeping.[17]

   In (19c), the topic time includes the external time, whereas in (19d), the topic time precedes the external time. At this topic time, Grüninger is assigned the posttime properties of sleeping. There is no lexical specification of what these properties are: the lexical content of *sleep* gives no information on what is the case with someone after a sleeping interval. He may sing or dance or work, he may be dizzy, it may even be still asleep. This last reading is not very suggestive in this case. It is more likely in (19e), where the time about which an assertion is made is only a subtime of a sleeping interval. Therefore, a sequence such as (19f) is quite natural:

(19)   f.   *Grüninger had been sleeping, when the phone rang.*

Let us now turn to a V_s with more than one AT-pair:

(20)   a.   *Plantin printed a bible.*
     b.   *Plantin was printing a bible.*

    c.   *Plantin has printed a bible.*
    d.   *Plantin had printed a bible.*
    e.   *Plantin had been printing a bible.*
    f.   *The bible was printed.*

In (20a) as well as in (20b), the topic time is in the past; the difference is only whether this topic time must include subintervals of both arguments (i.e., his activity as well as the unprinted and printed stage of the bible) or only needs to include some subinterval of his activity stage. The former leads to a "perfective" reading, the latter to an "imperfective" reading. In (20c), the topic time includes the external time, and for that time, the sentence assigns to Plantin the posttime properties of *print a bible*. Just as with (18a), this should be odd if Plantin does not exist at the external time, at least for speakers who know that he does not exist right now, and so it is. No such effect is observed for (20d): Plantin's time is coupled with some time in the past, and this should be fine. In (20c) as well as in (20d), the book must be printed at the topic time, and this is the intuitive feeling we have. In (20e), the topic time is in the past, it is after a subtime of Plantin's activity (*been printing*); but it is not asserted that the bible was ever printed. Example (20f), finally, has two readings: the underlying *be printed*, to which FIN-marking is applied, must overlap with the time at which the book is ready ("static passive"); it can also include a time at which the book is not yet ready and someone is active with whatever is necessary to print it ("dynamic passive").

    Let us conclude this tour through various English forms with two examples in which present tense is coupled with the future adverbial *tomorrow*. The first of them was already discussed above (Example 11):

(21)   a.   *We are leaving Riva tomorrow.*
        b.   *The train leaves Riva tomorrow at five.*

In (21a), the crucial question is what the descriptive properties of the "source time" of *leave* — the time of which *be leaving* selects a subinterval — are. They describe "our being active". If we assume that this being active does not require some actual moving, but also involves the planning stage, maybe packing and other preparatory activities of leaving a place, then this sentence should be fine, even if we assume that *tomorrow* specifies the entire "event time" (in the sense of (12), i.e., a time which includes subtimes of all intervals provided by V_s). It may well be, therefore, that a part of the source time of the first argument as well as parts of the two times of the second argument are included in the time described by *tomorrow*. At the same time, the source time of the first argument may overlap with the moment of speech. Hence, under the present account, there is not only no contradiction between the present tense and the future time adverbial *tomorrow* — the account also predicts the particular

flavor of this sentence: right now, we are somehow in the preparatory stage of leaving.

Such an explanation is not possible for (21b), an utterance with a very different flavor: rather than giving the impression that the train is in some initial stage of leaving, it has the flavor of a "scheduled time": it is somehow fixed when the train leaves (cf. Williams 2002). Under the present analysis, FIN-marking only requires the topic time to include the external time; it says nothing about the duration of the time to which the assertion made by (21b) is confined. The topic time can be a very short interval, it can also be a very long interval, which reaches into the future and into the past. If this time is indeed very long, the assertion is temporally less confined, and the statement has a more principled character. Such a long topic time can also fully include the "event time", even if this event time is in the future (as indicated here by *tomorrow at five*). This explains why (21b) is possible without contradiction and why it has its "scheduled character".

9.   Conclusion

In Section 2, it was argued that the classical notions of event time should be replaced by the more general notion of a clause-internal temporal structure which is closely connected to argument structure. An argument-time structure consists of a number of argument-time variable pairs; the temporal variables are related to each other by relations such as "overlapping, before, included in" and other ones. There are also other relations between AT-pairs, for example causal or modal relations; these were not considered here. The AT-pairs of a verb stem are connected to descriptive properties: as soon as the argument variables are filled, the verb stem assigns descriptive properties to these arguments at the matching times. AT-structure and the associated descriptive properties form the semantic features of the verb stem. In principle, there could be very many types of AT-structures. In actual fact, their number in English seems restricted to a few patterns — but this is an issue which requires further investigation.

More complex expressions are brought forth by a number of morphosyntactic operations which selectively change the phonological, morphological and semantic features of the expression to which they are applied. A few of these operations were considered here. They allow a very simple compositional analysis of traditional categories such as the (present and past) perfect, static and dynamic passives and the progressive. They predict many special effects of these constructions, for example the impression that the progressive somehow "looks into the interior" of the situation described. They also naturally

explain why constructions such as *the slept dog* or *the dog is slept* are not interpretable.

There is hardly any violation of the principle "one form — one meaning". The only major exception is the ambiguity of *-ed* as a marker of past tense and past participle. There are, of course, a number of idiosyncrasies on each level, such as irregular forms of the past participle or the restriction, that some forms on *-ing* cannot be combined with *be*, as in *(to) be knowing*. Essentially, they are historical residues, as often found in natural language.

What becomes under this approach of the classical notions Aktionsart, tense and aspect? Most Aktionsarten can systematically be reconstructed in terms of AT-structure and accompanying descriptive features (see the discussion in Section 2.2). Tense is reconstructed as the relation between the clause-internal temporal structure and some clause-external time, for example the time of utterance. The crucial link is the topmost time of the internal structure — the topic time. In the simplest case, the three tenses past, present and future are defined as temporal relations between the time of utterance and the topic time: the time of utterance may be before, included in, or after the topic time. There are several complications, for example when the topic time is not related to the deictically given time of utterance, but to the time of a higher *verbum dicendi vel sentiendi*, as in *Froben thought that Sweynheym was a lousy printer*.

Let us turn now to the notion of aspect, the way in which some event described by the utterance is "seen" or "presented", as traditional metaphorical characterizations of this notion have it. In simple cases, such as *Elzevier left, Elzevier had left, Elzevier was leaving*, aspect is the temporal relation between the highest temporal interval in the construction (the topic time), and the intervals which the topic time includes. In *Elzevier left*, these are subtimes of the three intervals provided by *leave*. Since the topic time includes parts of all intervals, it gives the impression that the event as a whole is shown within the time about which a claim is made: the event is shown in its totality, the verb form is "perfective". In *Elzevier has left*, the topic time only includes a time after a complete interval described by *leave*, whence the "perfect" — which is a combination of "after" and "completed". In *Elzevier was leaving*, the time to which the assertion is restricted is a proper subinterval of the source time of *leave*; it is completely open whether the second state is ever reached. It is possible, but it is not asserted; whence the feeling that only the interior of the event is shown: it is "imperfective".

In more complex cases, such as Example (2) *Caxton seemed to have planned to come at five*, the notion of aspect becomes somewhat fuzzy. If there is need, however, it can easily be defined, for example for the relation between the topic time and the temporal structure of *seem*. But such a definition does not include the "event proper", Caxton's potential leaving at five. If we want to include this part of the sentence as well, we have to include further temporal

relationships — *to come* is a "prospective", as seen from the time of his plan-ning, and his planning in turn is a "perfect" as seen from the time at which something seems to be the case. All of this is possible, but perhaps of little use.

Notes

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1. Binnick 1991 gives a comprehensive survey; see also Binnick's impressive — and somewhat
    discouraging — online bibliography www.scar.utoronto.ca/~binnick/TENSE/index.html.
    Dahl (2000) and Ebert and Zúñiga (2001) give a good impression of the state of the art for
    European and Non-European languages, respectively.
2. In "stage level predicates", the time of the adjective is a subinterval of the time of the noun,
    in "individual level predicates", the two times are identical. The temporal parameterization
    of adjectives and nouns along these lines also suggests a straightforward analysis of seem-
    ingly paradoxical constructions such as *the melted ice*, which, of course, is no ice when
    melted (on temporality in noun phrases, see Enç [1986]; Musan [1997]).
3. If t is a temporal interval, the a "posttime" of t is any time which is immediately after t, i.e.,
    t can have different posttimes, which differ by the time at which they end; analogously for
    "pretimes" of t (for a more detailed discussed of the various notions of time and on the tem-
    poral structure, as it is reflected in natural languages, see Klein [2009a]). Note that a post-
    time/pretime of t can have the same descriptive properties as t itself. After a sleeping interval,
    for example, there can be another sleeping interval. This is, for example, important for the
    analysis of expressions such as *still sleeping*, which adds a sleeping interval to a sleeping
    interval; we will come back to this in a moment. Terminologically, one could perhaps dif-
    ferentiate between the bare "posttime", on the one hand, and the "poststage", in which time
    and particular descriptive properties are combined, on the other. I shall not do this here, since
    both terms are often used interchangeably in the literature. Note that the familiar BECOME-
    operator does not separate between the function of a mere temporal shift and a change in
    descriptive properties: the argument must always become "something different".
4. Note that, of course, these verbs themselves don't say anything about whether these states
    ever obtain, let alone whether the second state is ever reached. This is only possible in rela-
    tion to some externally rooted time, for which such a claim can be made (see Section 7).
5. I believe that the higher-lower asymmetry of the same argument at two times is crucial for
    the meaning of these verbs; but it surely does not exhaust their descriptive content. In par-
    ticular, the two AT-intervals may have subphases with internal rises and falls, depending on
    the particular entity which is falling or rising. When the shares fell yesterday by 11%, then
    this fall is probably not monotonous, whereas when a tree fell, it is unlikely that there were
    some small rises in-between. In any event, these potential subintervals are not accessible to
    morphosyntactic operations, hence they are not relevant to the AT-structure.
6. Both sentences can (at least marginally) have a reading in which both times are affected. This
    is a characteristic scope ambiguity, if some operation applies to a monomorphemic expres-

sion with several AT-pairs: it cannot easily select between the possibility to apply to both or to just one of the intervals enshrined in this single morpheme.

7. More detailed considerations including a discussion what the AT-structure implies for case marking in German are found in Klein (2002).

8. I have chosen English here and in the following sections, first because any reader of this paper is easily able to verify the claims made here, and second because its temporal features are more extensively investigated than those of any other language; see, for example, Declerck (2006) for a recent and very comprehensive analysis.

9. As will be argued below, the construction *(to) be studying* yields a subinterval of *(to) study*; but this subinterval does is not characterized by specific properties; it is not, for example, the interval at which the subject learns the Russian aspect or rehearses the instrumental. In fact, this subinterval can be as unspecified with respect to these properties as the entire interval.

10. And, of course, that the latter would not be the case if we were not "active" — if we include the "cause relation".

11. I assume that a substantial part of argument realization can be described by a small number of default operations. In Germanic languages, a single argument is normally realized as the grammatical subject (and marked by nominative); this argument can be a one-time or two-times argument. If there is a one-time argument and a two-times argument, the former is normally realized as the grammatical subject and the latter as the direct object. As a consequence, the subject of an intransitive verb can be like the subject of a transitive verb or like the object of a transitive verb. This may underlie the familiar "unergative-unaccusative" distinction of verbs.

12. This term should not be given too much theoretical weight. It is just an easy way to refer to the argument-time pair which, at a given point, is subject to an operation.

13. This is surely not the only restriction on the use of the past participles in attributive constructions. Thus, we can say *the drowned giant*, but not *the died giant*. Some of these restrictions seem quite idiosyncratic; but there may also be more systematical constraints, an issue not to be discussed here.

14. Old English had a *beon/wesan*-passive as well as a *weordan*-passive; opinions disagree to some extent on whether the former was confined to static passive or whether it already had both readings (see the survey in Denison [1993: 413–445, especially 417–419]).

15. Precisely this is the main problem with Reichenbach's R — is it just another time span, or does it have certain descriptive properties? If not, the distinction between the various tenses in a Reichenbach framework breaks down, because there is always "another time span", which overlaps with S or E.

16. It does make sense, though, if we talk about Gutenberg as someone who, in a way, still exists, as in *Gutenberg has changed our world more than any other goldsmith*. Then, the sentence is not odd (or not for that reason).

17. Under this analysis, the simple form of a V_s with just one temporal interval can have an "imperfective" reading: the sleeping time can be properly or improperly contained in the topic time. This primarily depends on how long topic time and the sleeping time are understood to be in the relevant context: a short topic time in relation to a long sleeping time naturally leads to an "inside perspective", and vice versa. Moreover, the fact that there is a competing form — the progressive — which explicitly targets a subtime of the time provided by *sleep* invites a "perfective" reading of the simple form. This analysis seems to fit the intuitions best, or at least the intuitions of those I have asked. If such an imperfective reading is to be excluded, one would have to add "properly" to (15). If the verb involves more than one time span, such as with *come* or *cook*, it is automatically excluded, because subintervals of all their times must be included in the topic time.

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