TEMPORAL PREPOSITIONAL PHRASES WITH QUANTIFIERS: SOME ADDITIONS TO Pratt and Francez (2001)

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1. THE CLAIMS*

This article analyses cascades of temporal prepositional phrases (tPPs) as they occur in the following German sentence:

(1) Wolfgang hat während des letzten Sommers in keinem Monat an jedem Sonntag Tennis gespielt.

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Wolfgang has during the last summer in no month on every Sunday tennis played
'For no month last summer did Wolfgang play tennis every Sunday.'

With the exception of the paper by by Pratt and Francez (henceforth P&F) cited in the title, it has been claimed in the literature that tPPs are adjoined to the VP one by one and interpreted intersectively. Following P & F, it can be shown that this method is not capable of getting the semantics right. The thesis defended in this article is that only one tPP is adjoined to the VP. A quantifier embedded in a PP must be QRed and be adjoined to the VP at LF, in German even at S-structure. A complication arises from pied-piping: there is no preposition stranding in German; therefore, the P-head of a PP is moved together with the QRed NP. For the example given, the D-structure exhibits a word order which is the mirror order of what we see at S-structure:

(2) $[_{PP1}$ on $[_{NP1}$ every Sunday $[_{PP2}$ in $[_{NP2}$ no month $[_{PP3}$ during $[_{NP3}$ last Summer]]]]]] VP

The LF that corresponds to the surface structure in example (1) is obtained by successive QRing of the direct objects of the temporal prepositions:

(3) $[_{NP3}$ last Summer$]_3$ $[_{NP2}$ no month $[_{PP3}$ during $t_3]]_2$ $[_{NP1}$ every Sunday $[_{PP2}$ in $t_2]]_1$ $[_{PP1}$ on $t_1]$ VP

(3) is an "inverse linking" structure in the sense of May (1985). It can be shown that this structure gives us the correct interpretation under standard assumptions. As I said, a complication arises from the fact that the German QR-rule pied-pipes the prepositions. Thus, at S-structure we don't see NP3 in the front position, but PP3. Similarly for NP2 and NP3. Apart from this disturbance, German surface word order perfectly mirrors the transparent LF. As we will see, the logical syntax is less visible in configurational languages such as English or Italian. *In nuce*, this is the substance of the article. The theory is developed in sections 9 to 12, and the reader who is only interested in the systematic development of the analysis is invited to skip the preceding sections, which discuss the literature on the subject, above all, Pratt and Francez (2001).

P&F give a formal semantics for temporal PPs (tPPs) that contain a quantifier. These are adverbials like **during every meeting**, **on a Monday**, **before every meeting**, **during every meeting on a Monday before Christmas**. Adverbs like **today** and **every Monday** are subsumed

under this class; their preposition is phonetically empty. P&F address the issue of how the meaning of these expressions combines with the meaning of verbs. One would think that the answer should be very simple, but P&F claim – correctly, I believe – that these PPs have not yet been adequately analysed in the literature. P&F give a review of the relevant literature, which I will not repeat here. As a prominent example, P&F cite Dowty (1979). I believe that P&F's article is a significant contribution to a better understanding of these adverbs, and my paper merely restates and generalises their results within the framework of transparent LF.

I believe that an adequate treatment of temporal adverbs is only possible on the basis of an elaborate theory of tense and aspect in natural language. P&F don't talk about tense, but I will extend their analysis to tensed verbs. In so doing, I will do little more than try to get the semantics for the following sentences right:

(4) John was in Boston today. Dowty (1979: 324)

(5) John called every Monday. Heim (1997: 14)

The meaning of the second sentence as provided by P&F's theory can be paraphrased in a self-explanatory first order formula as follows:

(6) $\forall x[\text{MONDAY}(x) \,\&\, \text{time}(x) \subseteq \text{PAST}_i \rightarrow \exists e[\text{CALL}(\text{JOHN},e) \,\&\, e \text{ ON } x]]$

Everything in the formula follows from a systematic treatment of tPPs and a theory of tense and aspect. The past tense of the verb determines the occurrence of PAST_i in the expression – a free time variable, as we will see.

The formula embodies P&F's main idea, namely that the head noun of a temporal quantifier contains a time variable, called a (the) *context variable*, which is restricted by the tense of the clause or some higher temporal quantifier. In example (6), the noun **Monday** is restricted to a particular interval PAST_i. The formula shows that **every Monday** is interpreted as **on every Monday** and the quantifier **every Monday** is quantified into the tPP 'e ON x', where the latter restricts the VP CALL(JOHN,e), and where e is a Davidsonian argument.

The idea that temporal quantifiers are systematically quantified into their tPPs is not contained in P&F's account. They work with type lifting rules that make the semantics rather opaque and create problems, as we will see. So this part of the theory is my addition.

Actually, my own LF for sentence (5) is slightly more complicated than (6), viz. it is this:

(7) $\forall x[MONDAY(x) \& time(x) \subseteq PAST_i \rightarrow \exists e[CALL(JOHN,e) \& time(e) \subseteq PAST_i \& e \text{ ON } x]]$

The information 'time(e) $\subseteq$ $PAST_i$' contained in the event expression is not present in P&F's theory. For this particular example, it is redundant. But I will show that we need it in order to analyse the interaction of pluperfect with **after** correctly (see section 11). This information follows from Aspect theory, as we will also see.

The organisation of the article is as follows. The next four sections discuss a tensed version of P&F's theory. I show that one scope paradox arising with tPPs is solved by their account. In sections 6 and 7, I present data that are problematic for P&F's. analysis My quantifying-in approach is systematically introduced in section 9. Section 10 introduces the theory of aspect, notably aspectual relations. These are important for the correct interpretation of even simple examples. Sections 11 and 12 contain applications of the theory. In the last section, which is mainly concerned with German, I try to show that this language reveals on the surface the inverse linking configurations that we would expect in a theory that assumes quantifying-in to a PP.

2. SCOPE PARADOXES WITH TPPS

It has been known for three decades that a naive application of Prior's (1967) tense logic to natural semantics involves scope paradoxes. For temporal adverbs, the point has been made independently by Bäuerle (1979) and Dowty (1979). Bäuerle's (1979) example is

(8) Heute hat Ede eine Pizza gegessen.
Today has Ede a pizza eaten.
'Today, Ede ate a pizza.'

The following example is taken from Dowty (1979: 324).

(9) a. John is in Boston today.
b. John was in Boston today.
c. John will be in Boston today.

Consider example (9b). Suppose with Prior that **today(p)** means 'p is true today' and PAST

means ‘λpλI∃I’<I.p(I’)’.[1] Then neither of the following two formulas gives the correct truth-condition:

(10) a. PAST(TODAY(JOHN BE-IN-BOSTON))
b. TODAY(PAST(JOHN BE-IN-BOSTON))

To solve the problem, Dowty and Bäuerle introduced time variables into the formal language. Dowty’s formalisation of the sentence is as follows:

(11) ∃I[PAST(I) & I ⊆ TODAY & AT(I, BE-IN-BOSTON(J.))] Dowty (1979: 325)

In Dowty’s approach, PAST(I) means ‘I < NOW’, where NOW is the speech time. TODAY is a context dependent name, and ⊆ is the relation of temporal inclusion. So the temporal adverb **today** means ‘IN TODAY’. Dowty’s rules of temporal interpretation are rather complicated and need not concern us here. The LF clearly shows the strategy: the verb has a temporal argument, the ‘event time’. The tense relates the event time to the speech time, and the temporal adverb restricts the event time.

It has been known at least since Ogihara (1994) that this approach, too, is subject to a related scope paradox.

(12) a. John called every Monday.
b. ∃I[PAST(I) & ∀x[MONDAY(x) → ON(I, x) & CALL-AT(JOHN, I)]]
c. ∀x[MONDAY(x) → ∃I[PAST(I) & ON(I, x) & CALL-AT(JOHN, I)]]

(12b) entails that a particular past time is contained in every Monday and (12c) entails that every Monday is in the past. The first interpretation clearly is a non-starter. As to the second, Heim (1997: 14) comments:

> If the *every*-phrase happens to be contextually restricted to Mondays in the past, the structure (12c) [= Heim’s (32)] is adequate. But why does it have to be so restricted? The past tense is somehow responsible for this, but our analysis does not explain how.

Heim claims that the restriction should follow from a correct theory of presupposition. Presumably, this is the correct approach and hopefully the results obtained in this article can be

[1] I ranges over times in the meta-language. Prior thought of times as points, not as intervals. But the ontological status of times – points versus intervals – really doesn’t matter for the argument made in the text.

restated according to this idea. The relevant projection principle would be that the presupposition imposed to a time argument by a semantic tense is projected to a time argument occurring in the restriction of a temporal quantifier which binds this argument. I will not try to elaborate Heim's idea; rather, I will pursue the more direct proposal by P&F. I am not aware of a satisfying solution to the problem by Ogihara himself. P&S attribute to Ogihara the following analysis, clearly the wrong result:

(13) $\exists I[PAST(I) \& \forall x[MONDAY(x) \rightarrow ON(I, \tau(x)) \& CALL\text{-}AT(JOHN, I)]]$Ogihara (1995)

I am using the notation $\tau(x)$ for P&F's 'time(x)', i.e. the time of x, where x is an event or a time span.

Using the indefinite theory of tense, the solution P&F propose comes to this[2]:

(14) $\exists I[PAST(I) \& \forall x[MONDAY(x) \& \tau(x) \subseteq I \rightarrow \exists I'[CALL\text{-}AT(JOHN, I') \& ON(I', \tau(x))]]]$

It is interesting to note that the tense restricts the time variable contained in **Monday** but not the time variable of the verb, which is existentially quantified. We will see that this creates problems for the analysis of German **nachdem** 'after'-clauses. In any case, P&F's LF fulfils Heim's desideratum that the every-phrase be restricted to Mondays in the past.

This is not exactly P&F's solution, and I ought rather to say that their analysis *should* come to this. First of all, P&F don't treat tense at all; however, their remarks make it quite clear that it restricts the temporal context variable after all the relevant computations have been carried out. Second, P&F adopt a Davidsonian approach to verb semantics, which I will introduce later in this paper. This is a rather immaterial detail. The more important difference is that P&F fail to give a transparent meaning to temporal prepositions like **on**, **in**, **during** etc. This is due to their particular technical treatment of tPPs, which wants (tries) to be close to the syntactic surface and does a lot of type lifting. One of the somewhat puzzling results of their treatment is that these temporal prepositions can't have a simple meaning. My proposal will improve this point and

[2] One of the problems of the representation is that we have to make sure that the PAST-interval I must be sufficiently big. We can achieve this by a contextual restriction of the temporal quantifier by a free property variable C whose value is supplied by the context. So the proper representation of the semantic tense would be **$\exists I[C(I) \& PAST(I) \& ....]$** For a treatment along these lines, see Musan (1997) and Musan (2000).

make the logical syntax more transparent – though more abstract – than P&F's.

As I said, P&F's analysis of tPPs has the consequence that the time argument of a VP is existentially quantified if the VP is modified by a tPP. This works nicely for example (12) but the treatment cannot be correct for the Bäuerle/Dowty-sentences (9). Clearly we want to analyse adverbs like **today** as truncated tPPs meaning 't is on the actual day' or 't is throughout the actual day'. This is in fact what has always been done in the literature. Suppose we did that and assumed with P&F that the head noun of the tPP, i.e. ACTUAL-DAY, is restricted by a temporal variable, MONDAY, as in example (14):

(15) $\exists I[PAST(I) \ \& \ \mathbf{the}(\lambda x[ACTUAL\text{-}DAY(x) \ \& \ \tau(x) \subseteq I], \lambda x \exists I'[CALL\text{-}AT(JOHN, I') \ \& \ ON(I', \tau(x))])]]$

Obviously, this is not correct. The time of the actual day is not before the speech time; rahter, only part of it is before it. Dowty's analysis (11) fares better here, and we have to bring together the advantages of the two approaches without importing their flaws. Interestingly, P&F do not treat these sentences at all.

3. Some Treatments in the Literature

One would think that the correct semantics of tPPs must have been known from the literature for a long time. I agree with P&F that the known proposals are all unsatisfying. P&F give quite a detailed discussion of the literature, which I do not wish to repeat here. I will only mention one prominent example, viz. Dowty (1989). Consider the following sentence:

(16) Mary kissed John during every meeting.

According to P&F, Dowty (1989) would predict the following meaning for the example:

(17) $\exists I[\mathbf{every}(\lambda x[MEETING(x)], \lambda x[I \subseteq \tau(x) \ \& \ KISS\text{-}AT(MARY, JOHN, I)])]$ [69][3]

P&F claim that this follows from Dowty's intersective interpretation of temporal adverbs. For **during every meeting**, Dowty's analysis would be this:

[3] The numbers in square brackets refer to Pratt & Francez' (2001) numbering of the examples.

(18) tPP-rule attributed to Dowty (1989) by P&F
λPƎI[**every**(λx[MEETING(x)], λy[I ⊆ τ(y) & P(I)])] [68]

In Dowty's system, temporal adverbs intersect with temporal abstracts, in this particular case with:

(19) λI.KISS-AT(MARY,JOHN,I)

One of the problems of this account is that it is not clear how PAST-tense could modify the meaning given in (17). Presumably we can solve the problem by leaving the time variable I free or by λ-binding it. In the next step, we can restrict I to some past time. But even then the result would be the wrong reading because the formula implies that one particular past time is contained in the time of every meeting, which is nonsense.

P&F's diagnosis of Dowty's alleged failure reads as follows (see Pratt and Francez (2001:202)):

> Although Dowty only sketches an account of how his proposed semantics should deal with such cases, it is clear that he requires the time over which the reported event occurs to satisfy a *conjunction* of conditions – one imposed by each tPP. It is instructive in this regard to consider the only example Dowty gives:
>
> (70) I first met John Smith at two o'clock in the afternoon on a Thursday on the first week of June in 1942.
>
> In this example, the time of meeting is indeed one which is (i) at 2 o'clock in the afternoon, (ii) on a Thursday, (iii) in the first week of June and (iv) in 1942. But the fact that Dowty's account works here is entirely due to the absence of universal quantification in the tPP complements. If we consider instead sentence (63), then it no longer makes sense to regard the three tPPs as conjuncts.

The sentence (63) mentioned in the citation is the following one:

(20) Mary kissed John during every meeting on Monday before Christmas. [63]

We will see that each of the tPPs involved is interpreted conjunctively and we nevertheless obtain the correct interpretation.

As an example of correct truth-conditions, P&F mention the analysis given in Kamp and Reyle (1993: 5.5.2). They offer the criticism, however, that the analysis given there is ad hoc. We find LFs in the form of DRSs, but there is no systematic procedure or theory that generates

these.

As an example of a correct way of approaching the problem, I would like to mention Musan (2000: p. 130)[4]:

> **Principle of Integration of Temporal Quantificational Structures**:
>
> a. Any temporal quantificational structure is integrated into the semantic representation of the clause by an obligatory restriction linking the temporal variable it introduces to the temporal variable introduced by the next higher temporal quantifier.
>
> b. When this obligatory restriction is implicit, the linking is realized by the subinterval relationship, such that the value of the higher temporal variable includes the value of the lower temporal variable.

This sounds very similar to what P&F say and what I will say about the matter. But when it comes to implementation, we see that Musan's approach is not exactly what I have in mind. She analyses sentence (21a) as (21b):

(21) a. Lola rannte an jedem Montag. Musan (2000: p. 131)
Lola ran on every Monday.

b. ∃I[PAST(I) & **every**(λI*[on_Monday(I*) & I* ⊆ I], λI*∃I**[I** ⊆ I* & Lola_run(I**)])])]

I have adapted Musan's notation to the one used by P&F, omitting immaterial details of her formula. Clearly, the idea that **Monday** is relativised to a context time is there. And as in P&F's theory, the PAST-tense does not modify the event time but only the context variable of **Monday**. But **every Monday** is not quantified into the PP 'I* on I**' as it should be if I am right. In other words, Musan analyses 'on every Monday' as 'every on Monday' and not as 'every Monday on'. This observation might be pedantic, but if we don't observe it, we can easily get the LFs mixed up as happens with a simplified version of another sentence of Musan's:

(22) Das Telefon hat letzte Woche jeden Tag zwischen zwei und drei geklingelt.

[4] A very similar statement of this principle is found in chapter four of Ernst (1998).

The phone has last week every day between two and three rung.
'The phone rang every day between two and three last week.'
Musan (2000: p. 135)

Musan proposes the following LF (see p. 136):

(23) ∃I[PRES(I) & ∃I*[I* ⊆ I & **every**(λI**[day(I**) & last_week(t**) & between_two_and_three(t**) & t** < t*], λI**[the_phone_ring(I**)])]]

Presumably, **day(I**)** means 'I** is on (during) some day' and **last_week(t**)** means 't** is during the last week' in this context.[5] But then it is entirely unclear to me how **every** can bind the time variable of **last_week(t**)**. Musan doesn't give a systematic procedure for this. Even if this approach could be made precise, I cannot see how it could satisfactorily treat an example where the first temporal adverb contains a quantifier as well:

(24) Das Telefon hat in keiner Woche jeden Tag geklingelt.
The phone has in no week each day rung.
'The phone hasn't rung every day in any (one) week.'

Finally, consider the following example from Uli Sauerland:

(25) Wolfgang hat nach Leas Geburt an jedem Abend ein Bier getrunken.
Wolfgang has after Lea's birth on every evening a beer drunk.
'After Lea's birth, Wolfgang drank a beer every evening.'

For syntactic reasons alone, it seems hopeless to approach this sentence by the method proposed by Musan.

Musan (2000) contains one of the most elaborate accounts of tense and temporal adverbs that is available at present, so her failure to give a convincing account of tPPs provides more evidence from the literature that the behaviour of these adverbs is not so trivial and deserves our attention. In section 12, I will give a systematic treatment of sentences of this kind.

[5] In other contexts, **day(I)** must mean 'I is a day'. Take for instance the sentence **Not every day is a happy day**.

4. P&F's THEORY

We start with P&F's analysis of example (16). P&F assume a very simple syntactic structure, which we will refine in due course. The authors distinguish three levels of sentence meanings, **finalised S-meanings** (represented by the label S), **determined S-meanings** (represented by the label S1) and **undetermined S-meanings** (represented by the label S2).

Undetermined sentence meanings are relations between events and times. They are generated by applying the verb meaning to the arguments of the verb. For the example discussed, the lexical entry for the verb **kiss** is the following:

(26) kiss' = λyλxλeλI[KISS(x,y,e) & τ(e) ⊆ I] [20]

Meaning rules of this kind have a long tradition in tense semantics. Partee (1973) analyses the tenseless version of **I turn the stove off** as λI∃I'[I' ⊆ I & I turn off the stove at I']. This property is applied to a definite past time. Though Partee defends a definite analysis of the tense, the time variable of the verb cannot directly denote a particular past time, because the speaker cannot have in mind the exact time at which an achievement takes place.[6]

We apply (26) to **John'** and **Mary'** and obtain the following undetermined S2-meaning:

(27) [$_{S2}$ λeλI[KISS(Mary, JOHN, e) & τ(e) ⊆ I]]

P&F assume an extensional λ-language in the style of Gallin (1975), which allows only for binary branching. Therefore, the proper representation of the formula should be 'Schönfinkelised,' i.e. the verb without its temporal restriction should be written as [[[KISS e] Mary] JOHN]. This would make the notation very clumsy. I will follow P&F in assuming obvious writing conventions.

[6] Uli Sauerland observes that the strategy of including the information 'τ(e) ⊆ I' in the verb meaning might run into trouble with examples such as **Mary kissed/was kissing John for an hour**. Imagine a very long kiss to make the statement true. I think Sauerland's observation is correct. Ignoring the question of whether the progressive should be properly analysed as a modal operator (cf. Dowty (1979)), the representation of the tenseless progressive VP must be something like λeλI[KISS(Mary,JOHN,e) & τ(e) ⊃ I & **for an hour**(I)]. The information 'τ(e) ⊃ I' comes from the progressive. I see no obvious way to obtain this meaning on the basis of P&F's (in fact Partee's) verb meaning. My own approach will not encounter this problem because the relation ⊆ does not belong to the verb meaning but is linked to the aspect morphology.

A **determined S1-meaning** is obtained from (27) by quantifying over the event variable by a rule called **Sentence Determination**. This rule transforms S2-meanings into generalised quantifiers by applying a determiner meaning to them:

(28) λPλQ[R(P,Q)], R = **a**, **the**, **every** [p. 214]

These determiners are defined as nonempty intersection, as Russellian description and as inclusion, respectively. Temporal generalised quantifiers have the type <et,it> in this system, where i is the type of time intervals. Therefore, the application of a determiner meaning to an S2-meaning should generate a meaning of that type. In order to achieve that, P&F introduce a semantic operation called **Pseudo Application One**. The operation is denoted by $(_1)_1$ and defined as:

(29) $R(_1\varphi)_1$:= λQλI[R(λx[φ(x)(I)],Q)], R of the determiner type, φ of the S2-type [29]

In the case of the example (27), we obtain the following result:

(30) $\lambda P\lambda Q[\mathbf{a}(P,Q)](_1\lambda e\lambda I[KISS(Mary,JOHN,e) \,\&\, \tau(e) \subseteq I])_1$
$= \lambda Q\lambda I[\mathbf{a}(\lambda e[\lambda e\lambda I[KISS(Mary,JOHN,e) \,\&\, \tau(e) \subseteq I](e)(I)],Q)]$
$= \lambda Q\lambda I[\mathbf{a}(\lambda e[KISS(Mary,JOHN,e) \,\&\, \tau(e) \subseteq I],Q)]$

This is the desired S1-meaning.

The rule of **Finalisation**, which is not worked out in P&F's system, must state that the range of this relation is not empty. P&F achieve this by applying the relation to the trivial property T:

(31) Finalisation
$[_{S1}\ \lambda Q\lambda I[\mathbf{a}(\lambda e[KISS(Mary,JOHN,e) \,\&\, \tau(e) \subseteq I],Q)]\ ](T)$
$= [_S\ \lambda I[\mathbf{a}(\lambda e[KISS(Mary,JOHN,e) \,\&\, \tau(e) \subseteq I],T)]]$ [38]

This rule is an artifact of the system, which is due to the technical treatment of the event quantifier. The other two levels of sentence meaning are both needed for adverbial modification, however, as we will see in a moment. Let us turn to tPPs next.

As mentioned before, an essential property of the theory is that head nouns of temporal quantifiers have a context variable. For instance, the noun **meeting** has the following meaning:

(32) meeting' = λxλI[MEETING(x) & τ(x) ⊆ I] [88]

In order to create the generalised quantifier (33b), **every** is pseudo applied to the noun exactly as demonstrated in the calculation above. The result is:

(33) every meeting' = λPλI[**every**(λx[MEETING(x) & τ(x) ⊆ I],P)]

The tP **during** is defined in a way that it can take arguments of this logical type:

(34) during' = λ℘λPλI[℘(λy[P(τ(y))],I)] [34]

Never mind that this rule is intuitively virtually incomprehensible. I will comment on this later. For the time being, it suffices that it will yield the correct results for the example discussed.

The meaning of the tPP **during every meeting** is calculated by ordinary functional application:

(35) during every meeting' =
= λ℘λPλI[℘(λy[P(τ(y))],I)](λPλI[**every**(λx[MEETING(x) & τ(x) ⊆ I],P)])
= λPλI[λPλI[**every**(λx[MEETING(x) & τ(x) ⊆ I],P)](λy[P(τ(y))],I)]
= λPλI[**every**(λx[MEETING(x) & τ(x) ⊆ I], λy[P(τ(y))])] [36]

We apply the tPP to the finalised S-meaning and obtain the desired result, as the following calculation shows:

(36) [$_S$[$_S$ Mary kissed John] [$_{PP}$ during every meeting]]' =
= λPλI[**every**(λx[MEETING(x) & τ(x) ⊆ I], λy[P(τ(y))])]
(λI[**a**(λe[KISS(MARY,JOHN,e) & τ(e) ⊆ I], T)])
= λI[**every** (λx[MEETING(x) & τ(x) ⊆ I], λx[**a**(λe[KISS(MARY,JOHN,e) & **τ**(e) ⊆ τ(x)],T)])] [39]

P is of type <e,t>, but since times are special individuals in P&F's system, there is no type mismatch and we can apply the PP-meaning to the S-meaning. T is the trivial property true of everything, and **a** and **every** have the standard interpretations, i.e. they express non-empty intersection and the subset relation respectively. P&F do not distinguish between event and individual variables. For better readability, I will represent events by the letter e (a variable), but with P&F I will assume that events have the same logical type as individuals, i.e. e (a type).

Variables for time intervals are represented by the letter I; they have the type i. As already noted, the logical language used is an extensional typed λ-categorial language in the style of Gallin (1975). The type s of worlds doesn't play a role here – except for one example to be discussed in section 7 – and is therefore omitted. I will presuppose an ontology of intervals and events; I refer the reader to other literature, e.g. Herweg (1990) or Kamp and Reyle (1993).

5. TENSE AND THE SOLUTION TO ONE SCOPE PARADOX

P&F do not treat tense, but it is clear that tense has to bind the contextual variable of the finalised S-meaning. We could define tense as an existential quantifier in the style of Dowty (1979), Ogihara (1989), Herweg (1990) and many others. For the applications that we wish to discuss it is, however, more convenient to follow Partee (1973), Heim (1994), Kratzer (1998), Kusumoto (1999) and Katz and Arosio (2001), who?all regard semantic tenses as free variables whose value is determined by an assignment delivered by the context. The following semantic rules will suffice:

(37) **Semantic Tenses** are symbols of type i which bear time variables as indices. Let c be the context of the utterance with t_c the speech time.

a. $\| \text{PRES} \|^{g,c}$ is the speech time t_c.

b. $\| \text{PAST}_j \|^{g,c}$ is defined only if g(j) precedes the speech time t_c. If defined, $\| \text{PAST}_j \|^{g,c} = g(j)$.

c. $\| \text{FUTR}_j \|^{g,c}$ is defined only if g(j) follows the speech time t_c. If defined, $\| \text{FUTR}_j \|^{g,c} = g(j)$.

A PAST-version of P&F's example (16) is now obtained by functional application of the finalised S-meaning to a PAST-variable:

$[_S\, \text{PAST}_7\, [_S$ Mary kissed John during every meeting]]' =

$= \lambda I[\textbf{every}\ (\lambda x[\text{MEETING}(x) \,\&\, \tau(x) \subseteq I], \lambda x[\textbf{a}(\lambda e[\text{KISS}(\text{MARY}, \text{JOHN}, e) \,\&\, \boldsymbol{\tau}(e) \subseteq \tau(x)], T)])](\text{PAST}_7)$

$= \lambda I[\textbf{every}\ (\lambda x[\text{MEETING}(x) \,\&\, \tau(x) \subseteq \text{PAST}_7], \lambda x[\textbf{a}(\lambda e[\text{KISS}(\text{MARY}, \text{JOHN}, e) \,\&\, \boldsymbol{\tau}(e) \subseteq \tau(x)], T)])]$

This means that every meeting in a contextually determined past time has the property that a kissing with Mary as the agent and John as the undergoer occurred in it. Ogihara's sentence (12) is analysed exactly in the same way with obvious modifications.

As mentioned earlier, the theory has the interesting property that the tense doesn't restrict the time variable belonging to the verb anymore, at least not in a direct way. This is a possible drawback because I don't see how the Bäuerle/Dowty (9) sentences can be analysed in a straightforward way with this theory.

6. More Scope Ambiguities

One of the properties of P&F's system is that the object of the preposition **during** stands in a strictly local relation to the preposition. In fact, it always takes the modificandum into its direct scope. The discussion of this section will show that that account makes the correct predictions for English in most cases. At the end of the section, I will point out some data which may be problematic for the approach.

(38) Every student slept during some meeting

Some meeting can have either narrow or wide scope with respect **to every student**. So we have two readings which can be represented in the following very simple way:

(39) a. $\forall x[\text{STUDENT}(x) \rightarrow \exists y[\text{MEETING}(y) \ \& \ \tau(y) \subseteq \text{PAST}_7 \ \& \ \exists e[\text{SLEEP}(x,e) \ \& \ \text{DURING}(\tau(e),\tau(y))]]]$

b. $\exists y[\text{MEETING}(y) \ \& \ \tau(y) \subseteq \text{PAST}_7 \ \& \ \forall x[\text{STUDENT}(x) \rightarrow \exists e[\text{SLEEP}(x,e) \ \& \ \text{DURING}(\tau(e),\tau(y))]]]$

My representations look as if the specific reading requires the scoping of **some meeting** out of the tPP and over the subject **every student** (and I do in fact believe that this is the correct analysis). But P&F cannot have it that way. For them, reading (39b) is the unmarked one; it is obtained by applying the tPP **during some meeting** to the finalised sentence **every student slept**:

$[_S\ [_S$ every student slept] during some meeting]' =

$= \lambda P \lambda I[\textbf{some}(\lambda x[\text{MEETING}(x) \ \& \ \tau(x) \subseteq I], \lambda x[P(\tau(x))])(\lambda I[\textbf{every}(\lambda y[\text{STUDENT}(y)],$

λy[**a**(λe[SLEEP(y,e) & τ(e) ⊆ I], T)])]

= λI[**some**(λx[MEETING(x) & τ(x) ⊆ I], λx[**every**(λy[STUDENT(y)], λy[**a**(λe[SLEEP(y,e) & τ(e) ⊆ τ(x)], T)])])]

The adverb has to apply before the tense rule applies. Otherwise, $PAST_7$ cannot bind the time variable of **meeting**.

Reading (39a) must be generated by scoping **every student** over the tPP **during a meeting**. That is, before the application of the tense rule, the LF of the sentence must be this:

[$_S$ every student λ_x [$_S$ [$_S$ t_x slept] during some meeting]]'

P&F don't treat negation in their article, but it is fair to conclude that negative statements are treated in exactly the same way. The prediction of the theory seems to be that the following sentence has, among others, the two readings indicated:

(40) a. Every student didn't sleep during a meeting.*

b. ∀x[STUDENT(x) → ¬ ∃y[MEETING(y) & τ(y) ⊆ $PAST_7$ & ∃e[SLEEP(x,e) & DURING(e,τ(y))]]]

c. ∃y[MEETING(y) & τ(y) ⊆ $PAST_7$ & ¬ ∀x[STUDENT(x) → ∃e[SLEEP(x,e) & DURING(e,τ(y))]]]

In both cases, the tQ has wide scope with respect to the sentence determiner. This seems to be the correct prediction for English.

Next, consider ambiguities arising with cascades of temporal quantifiers in PPs. P&F give the following example:

(41) Mary kissed John during every meeting on a Monday. [84]

Here, **a Monday** can have narrow or wide scope with respect to **every meeting**. The wide scope reading is obtained by applying the tPP **on a Monday** to the finalised S **Mary kissed John during every meeting**:

(42) [$_S$[$_S$ Mary kissed John during every meeting] on a Monday]' =

* For my Australian informant, Angela Cook, this is plain rubbish.

= λI[**a**(λy[MONDAY(y) & τ(y) ⊆ I],λy[**every** (λx[MEETING(x) & τ(x) ⊆ τ(y)], λx[**a**(λe[KISS(MARY, JOHN, e) & **τ**(e) ⊆ τ(x)],T)])])]

The narrow scope reading requires a new rule, however. The tPP must restrict the meetings to meetings occurring on a Monday. The structure that expresses the reading in question is this:

(43) $[_S[_S$ Mary kissed John] during every $[_{tN}$ meeting on a Monday]]

The complex tN **meeting on a Monday** is translated as

(44) λxλI[**a**(λy[MONDAY(y) & τ(y) ⊆ I], λy[MEETING(x) & τ(x) ⊆ τ(y)])]

In order to be able to semantically compose the head noun **meeting** and the tPP **on a Monday**, P&F introduce the semantic operation **Pseudo Application Two**, denoted by $(_2)_2$.

(45) $\lambda P_{<\tau,t>}[\psi(P)](_2\lambda x_\sigma \lambda u_\tau[\varphi(x,u)])_2 := \lambda x.\psi(\lambda u.\varphi(x,u))$ [94]

The reader may calculate for herself that [on a Monday]'$(_2$meeting'$)_2$ is in fact the desired meaning given in (44).

In all these examples a tPP modifies a determined S. The following example is a case where the tPP **on a Monday** applies to an undetermined S-meaning.

(46) Jane telephoned John whenever Mary arrived on a Monday. [19]

The necessity to apply the tPP to an undetermined S-meaning is best seen when we represent the intended meaning as a predicate logic formula:

(47) λI[**∀**e[∃x[MONDAY(x) & τ(x) ⊆ I & ARRIVE(MARY,e) & ON(τ(e),τ(x))] → ∃e'[CALL(JANE, e') & WHEN(τ(e'), τ(e))]]]

The quantifiers ∀e and ∃e' create the determined S-meanings. Clearly the two parts of information that form the information of **on a Monday**, i.e. '∃x[MONDAY(x) & τ(x) ⊆ I' and 'ON(τ(e),τ(x))' are both in the scope of ∀e. It should be obvious then that this tPP modifies an S1-meaning. I don't want to commit myself to a precise semantics of the WHEN-relation. The most natural reading for WHEN(τ(e'), τ(e)) seems to be that e' is a bit later than e, but overlap or even strict simultaneity seems possible as well. There is abundant literature on that topic starting with Heinämäki (1974) and including contributions such as Moens and Steedman

(1988), Herweg (1990), Johnston (1994) and many others.

To be sure, (47) is not P&F's notation. They represent the temporal adjunct clause as:

(48) whenever Mary arrived on a Monday =
λPλI[**every**(λe[**a**(λx[MONDAY(x) & τ(x) ⊆ I], λx[ARRIVE(M.)(e) & τ(e) ⊆ τ(x)],
λe[P(τ(e))])]

If we pseudo apply this to the S1-meaning of **Jane telephoned**, we obtain the correct result.

In the examples discussed so far, the temporal quantifier in the object position of a tPP has always had wide scope with respect to 'its' sentence determiner. This holds even for the last example because there the relevant sentence determiner is the existential quantifier that belongs to the sentence **Jane telephoned**, and the quantified sentential **ever Mary arrived on a Monday** has wide scope with respect to this determiner. This raises the question of whether we have cases in which the quantifier has narrow scope with respect to 'its' determiner. Admittedly, in P&F's syntax we cannot even formulate what the question means precisely, because the object of a tPP doesn't scope at all. Only the tPP does, and it is a result of the semantics of the tP that the tP-object has scope over everything in the scope of its tPP. But with less sophisticated semantics (and more abstract syntax), the question of whether there are cases in which the tP-object has narrow scope with respect to its sentence determiner makes sense. Consider the following examples:

(49) a. Jane kissed John before all the meetings.
b. Jane kissed John after all the meetings.

English speakers seem to agree that these sentences are ambiguous. They have the readings discussed before, as well as a reading where the kissing is before any of the meetings started or after every meeting was over. It might be the case that this has to do with the meaning of **all**, which is somehow different from **every**, though I don't know what the difference is. For the time being, let us assume that the two determiners mean the same. The most straightforward analysis of the readings in question is then the following:

(50) λI∃e[KISS(JANE,JOHN,e) & ∀x[MEETING(x) & τ(x) ⊆ I → BEFORE/AFTER(τ(e), τ(x))]]]

I admit that this is not a very strong argument because **all the meetings** might be a definite

plural term and could have wide scope with respect to **Jane kissed John**.

Presumably the following data, which are taken form the web, have readings which are best analysed along these lines:

(51) a. Read our interview tips before any interviews.[7]

b. On 24 March 2000, before any of the political conventions happened, I took an online survey at www.SelectSmart.com to find **...** [8]

c. The walnuts must be pickled green, before any shell has formed.[9]

d. All HTTP headers must be sent before any content is sent to the browser.[10]

The analysis of these is tricky in each case because an imperative or a deontic modality is involved. Let us consider the first sentence and interpret, following Cresswell (1973: 235-236), the imperative as the second person singular future. A plausible analysis of the sentence would then be this:

(52) $\exists e[\text{READ}(\text{YOU},\text{OUR-TIPS},e) \,\&\, \tau(e) \subseteq \text{FUTR}_7 \,\&\, \forall x[\text{INTERVIEW}(x) \,\&\, \tau(x) \subseteq \text{FUTR}_7 \rightarrow \text{BEFORE}(\tau(e),\tau(x))]]$

The FUTR_7 enters the restriction via the tense rule along the lines discussed. P&F cannot have this interpretation at all. Now, following Ladusaw (1979), most semanticists analyse **any** as a negative polarity item meaning 'some'. So the universal quantification found in the formula doesn't stem directly from **any** but has its source in a more complicated 'donkey'-analysis whose details are not clear to me. The point, however, is that the universal quantifier $\forall x$ must have narrow scope with respect to the sentence determiner $\exists e$.

7. Discussion: the Meaning of Temporal Prepositions

P&F's system fares quite well for English. In this section I want to ask and answer one question: why is the meaning of **during** so complicated or even opaque in P&F's system? We

[7] www.candocareer.com/career-coaching/interview-tips.htm

[8] www.angelfire.com/az2/poland/pres.htm

[9] www.recipecottage.com/preserving/pickled-walnuts03.html

[10] www.foxweb.com/document/ResponseObject.htm

have the clear intuition that the preposition simply expresses temporal inclusion. The same holds for other temporal prepositions like **before**, **after** and **until** as we shall see. Let us start with the preposition **during**. Recall that its meaning is the following one:

(53) during' = $\lambda\wp\lambda P\lambda I[\wp(\lambda y[P(\tau(y))],I)]$ [34]

The opacity of the rule is felt by P&F as well, since on p. 197 we read the following comment on the rule:

> Intuitively, the word **during** seems to denote some sort of containment or inclusion relation. Yet the proposed meaning rule (34) contains no occurrence of $\subseteq$. True, but the meaning of the whole tPP **during every meeting** given in (36) does reveal an occurrence $\subseteq$, *but not in the way one would expect*. For here, it is the times of the meetings that are constrained to fall within some other interval, not the other way round.

Remember that the meaning of **during every meeting** is the following:

(54) $\lambda P\lambda I[$**every**$(\lambda x[MEETING(x) \& \tau(x) \subseteq I], \lambda y[P(\tau(y))])]$

This remark suggests that **during** provides the information '$\tau(x) \subseteq I$' found in the restriction of the formula (54). But this can't be the case because this information comes from the lexical entry for the noun **meeting** (cf. (32)). There is a second occurrence of $\subseteq$ in the meaning of the modified sentence (36). But this meaning comes from the embedded determined S, i.e. from:

(55) $\lambda I[$**a**$(\lambda e[KISS(MARY,JOHN,e) \& \tau(e) \subseteq I], T)]$

Clearly, **during** is not responsible for any of the two occurrences of $\subseteq$ in the sentence meaning (36). So what is the meaning of **during**? It seems to be a type adapter: while **every meeting** is true of a set of properties of events – we are considering meetings as events – **during every meeting** is true of a set of properties of times, namely those properties that are true of the time of every meeting. This is a logical operation; **during** doesn't seem to express any temporal relation in P&F's system.

What about other temporal prepositions like **before** and **after**? Clearly they cannot be treated as purely type adapters. Common sense tells us that **before** is a relation holding of two times, two events, or an event and a time, if the former is before the latter. Similarly for **after**. Let us look therefore how P&F treat a sentence like the following one:

(56) Mary kissed John before every meeting.

The simplest analysis of the meaning seems to be this:

(57) $\forall x[\text{MEETING}(x) \ \& \ \tau(x) \subseteq \text{PAST}_7 \rightarrow \exists e[\text{KISS}(\text{MARY},\text{JOHN},e) \ \& \ \text{BEFORE}(\tau(e), \tau(x))]]$

Here BEFORE expresses the <-relation between the event time and the reference time PAST_7. But P&F cannot have this because this formalisation misses the information '$\tau(e) \subseteq I$' contained in the lexical semantics of the verb. Thus, the architecture of P&F's system doesn't allow temporal prepositions to express relations between times. So P&F somehow have to mimic this meaning. And this is their treatment.

Suppose we are given an interval I and an event e occurring in that interval. Then **time-to(I,e)** gives us the time in I that abuts e from the left and **time-from(I,e)** is the time in I that abuts e from the right:

(58) I: [----------|//////////|+++++++] [45]
time-to(I,e) = ---------
time of the meeting e = /////////
time-from(I,e) = ++++++

time-to and **time-from** are partial functions and are the meanings proper of the prepositions. These are definite times, not relations between times. The syntactic meanings for **before** and **after** are generated by an appropriate type-shifting:

(59) a. before' = $\lambda\wp\lambda P\lambda I[\wp(\lambda y[P(\textbf{time-to}(I,\tau(y)))],I)]$ [49]
b. after' = $\lambda\wp\lambda P\lambda I[\wp(\lambda y[P(\textbf{time-from}(I,\tau(y)))],I)]$ [50]

The following interpretations reflect the semantic composition in for the tPPs **before** and **after the meeting**:

(60) before every meeting'
$= \lambda P\lambda I[\textbf{every}(\lambda x[\text{MEETING}(x) \ \& \ \tau(x) \subseteq I], \lambda y[P(\text{time-to}(I, \tau(y)))])]$ [51]

(61) after the meeting'

= λPλI[**every**(λx[MEETING(x) & τ(x) ⊆ I], λy[P(time-from(I, τ(y)))])] [52]

If we apply these tPPs to the S-meaning (31), we obtain the distributive reading, as the reader may check for herself.

(62) λI[**every**(λx[MEETING(x) & τ(x) ⊆ I], λx[**a**(λe[KISS(MARY, JOHN, e) & τ(e) ⊆ **time-to/from**(I,τ(x))], T)])]

This still works fine, but we face a problem if we look at sentences that have been discussed by Geis (1970) and that exhibit a long dependency between **before** and **after** and the time modified by them. The following examples are cited from Larson (1990: 170):

(63) a. I saw Mary in New York [$_{PP}$ before [$_{CP1}$ she claimed [$_{CP2}$ that she would arrive]]]
b. I encountered Alice [$_{PP}$ after [$_{CP1}$ she swore [$_{CP2}$ that she had left]]]

The sentences have readings that can roughly be paraphrased as:

(64) a. I saw Mary before the time I: Mary claimed that she would arrive at I
b. I encountered Alice after the time I: she swore that she had left at I

Larson (1990: 178) represents reading (63a) as:

(65) [$_{PP}$ before [$_{CP1}$ O_i she claimed [$_{CP2}$ t_i that she would arrive t_i]]]

O is an 'operator phrase' that undergoes cyclic A-bar-movement. Larson doesn't commit himself to a meaning of O, but the paraphrases (64) suggest that the operator means something like 'the smallest time', which I will represent as '**the min** λI[...I...]' (cf. Sauerland (2001) for a related analysis)[11]. Furthermore, Larson does not say how the trace t_i is semantically related to the verb. In an event approach the most straightforward assumption is that it is related to the event by the abstract tPP AT. A plausible LF for the CP1 is therefore the following expression:

(66) **the min** λI∃e[CLAIM$_{@}$(MARY,λ$_w$λI'∃I*[I*>I' & ∃e'[ARRIVE$_w$(MARY,e') & τ(e') ⊆ I* & AT(τ(e'),I)]]) & τ(e) ⊆ PAST$_7$]

Here, @ is the actual world. The representation neglects the problems of temporal *de re* interpretation, which have been discussed extensively in the literature (see for example Abusch

[11] **min** := λPλI[P(I) & ¬∃I'[I' ⊂ I & P(I')]], P a set of times.

(1997)). Obviously, the LF requires scoping of the operator **the min λI**.

As it stands, P&F's system doesn't allow the generation of this reading at all. The reason is that the tP **before** takes temporal quantifiers as arguments. The rule of Sentence Determination converts S2-meanings into temporal quantifiers, but the rule does this by quantifying over the highest free event variable (recall the example (30)). The analysis of Geis' examples, however, seems to require abstraction over a time variable of a lower clause. To be sure, P&F do not analyse sentential complements at all. They must be intensions of the sort exhibited by the complement of CLAIM in the formula (66). We can try to adjust the tPP AT(τ(e'),I) to P&F's format along the lines of their treatment of **before** and **after**. But even then the operator 'min I' must bind the temporal variable I, i.e. we must be able to quantify into tPP, an option that will lead to a more transparent system anyway and which we will discuss in the following sections. So the outcomes of this discussion are firstly that P&F's system cannot give a transparent meaning to temporal prepositions and secondly that it faces problems with the treatment of long dependencies.

8. INTERMEDIATE SUMMARY

I accept that the head nouns of temporal quantifiers have a time variable that may be restricted by the tense of the clause. This feature of the theory solves the scope paradox exhibited by the Ogihara sentences, i.e. (5)/(12a).

I accept that there is something like P&F's Sentence Determination rule that quantifies over the event variable (or event time). In fact, this rule largely seems to coincide with Bäuerle's (1979) adverb of quantification.

I accept that in English a temporal quantifier contained in a tPP has wide scope over the sentence determiner in most cases, but...

I am not sure that this is always so. There might (may) be cases where the temporal quantifier has narrow scope with respect to the sentence determiner (see (49) and (51)).

Long dependencies under prepositions such as **before** and **after** require quantifying into tPPs. P&F's theory cannot treat the Geis sentences.

Intuitively, temporal prepositions simply express relations between times. An adequate treatment should conform to these intuitions. While P&F treat tPs as complicated

syncategorematic words, a quantifying-in approach restores the intuitions. The meanings common sense dictates for temporal prepositions should be these:

(67) **Temporal Prepositions** have the type <ee,t>.[12]

a. || DURING || = || ON || = λIλJ[J ⊆ I]

b. || BEFORE || = λIλJ[J < I]

c. || AFTER || = λIλJ[J > I]

I will assume that these relations are defined either for times or for events. If the arguments are events, then this is automatically understood as the time of the event. For instance, if e is an event and x is a meeting, then DURING(e,x) means the same as DURING(τ(e),τ(x)).

Let us accept this simple semantics for temporal prepositions. Then P&F's surface syntax has an obvious problem with Geis' sentences and German examples exhibiting an inverse linking configuration. The reason is that P&F's rules of tPP-formation are too local. They cannot express movement of one quantifier over another and thereby change the relative scope of the quantifiers. In the conclusion I will make this criticism more precise. The account to be developed in the next sections will overcome each of theseproblems.

9. QUANTIFYING INTO PP

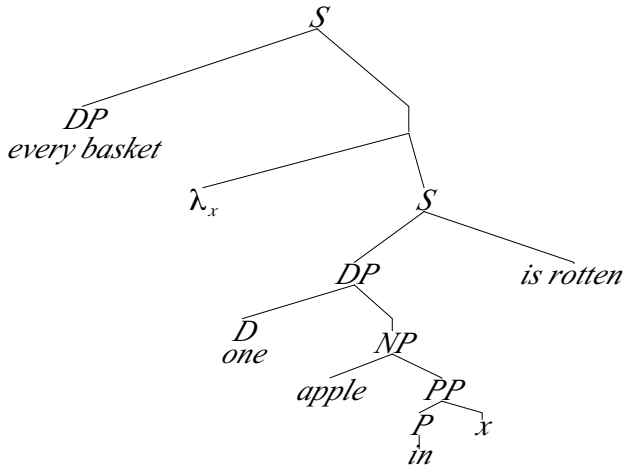
The solution of the problems involves quantifying into PP in the familiar sense. As a starter, let us consider a sentence discussed in Heim and Kratzer (1998:197 f.):

(68) One apple in every basket is rotten

The LF given by Heim & Kratzer is this.

(69)

[12] I use obvious abbreviations for types. <ee,t> stands for <e,<e,t>>, i.e. for two-place functions from individuals into truth-values.



The object is quantified in by Montague's (1973) Quantifying-in rule or May's (1977) rule QR, which leaves a λ-bound variable. The NP-head **apple** is intersected with the set denoted by **in x** and this gives us the intended interpretation. Obviously we can iterate the construction and have what is called a cascade of quantifying PPs:

(70) One apple in every basket on some table is rotten.

A possible interpretation is indicated by the following LF:

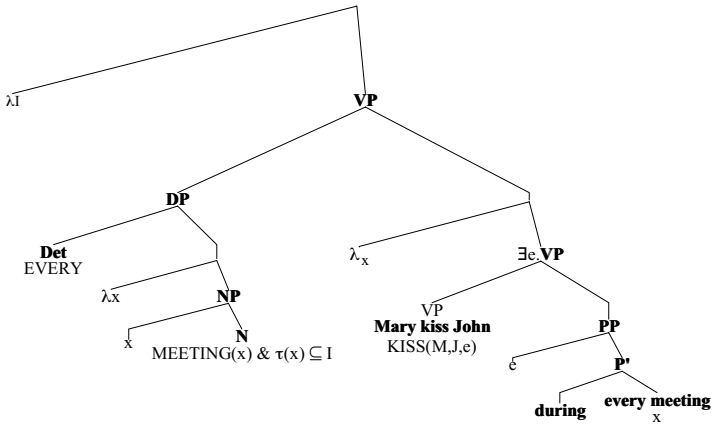
(71) some table λ_x[every basket on t_x λ_y [one apple in t_y is rotten]]

We first QR-ed the complex DP **every basket on some table**, leaving the trace **y**. In the next step we QR-ed some table and left the trace **x**. Using the standard interpretation of the λ-language, this gives us one possible reading of the sentence. But the more natural interpretation is that in which **some table** has narrow scope with respect to **every basket**, i.e. we must be able to quantify into the PP and generate an LF such as this one:

(72) every [basket ∩ λ_y[some table λ_z[y on t_z]] λ_x[one apple in t_x is rotten]

So prepositions should better have subjects in the LF. That is, *on some table* is generated from the structure **[$_{PP}$ y [$_{P'}$ on some table]]** by applying QR to the object. I want to propose that more or less the same analysis is given to tPPs.More specifically), I suggest that P&F's LF (17) should be replaced by the following transparent LF:

(73) (to be revised)



The lexical information is indicated by small letters. The capitalised letters refer to the LF representation. The logical types of the nodes are omitted, but some syntactic nodes contain the necessary 'logical glue' (Sternefeld's (1998) term) like existential quantifiers, lambdas, and relativisation to a time. I will speak about the latter in a moment. Two sister nodes of type t are interpreted conjunctively by a rule that Heim (1982) calls **Cumulative Interpretation**; a variant of the rule is the rule that intersects two sets and which is called Predicate Modification in Heim and Kratzer (1998). It is obvious that this tree determines the following formula in a straightforward way.

(74) λI[**every** (λx[MEETING(x) & **τ**(x) ⊆ I], λx∃e[KISS(MARY, JOHN, e) & τ(e) ⊆ τ(x) & DURING(e,x)])]

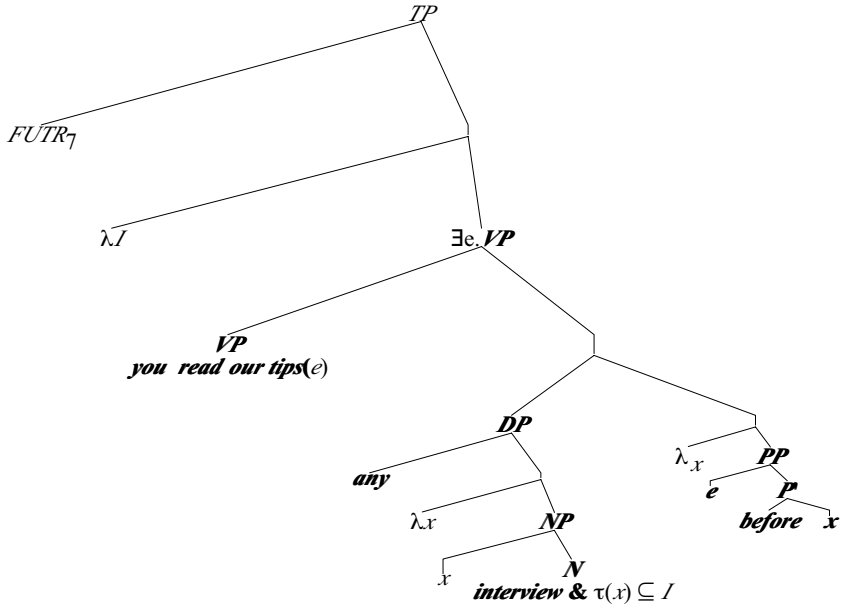
This formula has the same truth condition as (17), but there are some differences. To begin with, temporal prepositions have the transparent meanings indicated in (67). A second difference is that the VP-meaning is simply a set of events, i.e. the relativisation to the evaluation time is done when needed. We will return to this point.

I am assuming that the event variable can be existentially closed. This is a special case of P&F's Sentence Determination rule. Virtually everyone assumes such a rule. But I think that P&F are quite right in requiring a rather general rule that can convert undetermined S-meanings into definite terms and universal quantifiers as well. I will return to this point as well.

A crucial feature of this logical syntax is that temporal quantifiers are quantified into the PP by means of the QR rule mentioned above. One benefit of the method is that the DP **every meeting** can now have narrow scope with respect to the existential quantifier ∃e. For instance,

the tree for the LF (52) is given by the following structure.

(75)



I take it that **any** means **every** in this context.

As it stands, the account overgenerates for English. It doesn't follow from the system that the objects of tPPs have wide scope with respect to the sentence determiner ∃e in most cases. We need restrictions that are not formulated in this paper.

10. Event Time and Aspectual Relations

P&F say little about the internal structure of the VP. They assume that event time of a verb is always determined by the relation τ(e) ⊆ I. In this section I want to argue that this relation is a special **aspectual relation**, which is often called PERFECTIVE in the literature. There can be other aspectual relations, especially the relation τ(e) < I, which is often called PERFECT. I will argue that the verb meaning proper should be kept apart from these relations, i.e., eventives should be event types not related to times. It is only the aspectual relations that connect the event described by the verb with the reference time. TPPs modify the event directly and leave the reference time introduced by the aspectual relation free for temporal modification. This more refined structure will enable us to treat the Bäuerle/Dowty sentences correctly.

Nowadays most syntacticians assume a syntax with functional projections that have functional nodes such as Aspect and Tense. The proposals are very different in detail, but there is a growing consensus that we have to distinguish carefully between **morphological** and **semantic tense**. One of the clearest statements of this distinction is found in Heim (1994). In the same way, I want to distinguish between **morphological** and **semantic aspect**. For the purposes of the discussion I will assume the following Tense/Aspect-architecture:

(76) $[_{TP}$ sem. tense $[_{T}$ morph. tense$]$ $[_{AspP}$ aspectual relation $[_{AspP}$ morph. aspect$]$ VP$]]$

The structure ignores further projections needed for the auxiliaries and for the participle. Recall that our semantic tenses $PAST_i$, and $FUTR_i$ are temporal variables, and PRES is a deictic constant.[13]A morphological tense need not be interpreted as one and the same semantic tense. For instance, semantic future is mostly expressed by a present form in German and many other languages or by a future auxiliary in the present tense. All this is uncontroversial.

What is not so well established and in fact a permanent source of confusion is the notion of aspect. The classical aspectual distinction is the one between **perfective** and **imperfective aspect** in the Slavic languages. I will take this as a purely morphological distinction without going into the question of whether the distinction always has a morphological base. For a recent discussion, see Filip (1999). There is a wide consensus among semanticists that Slavic perfective morphology indicates the telicity of the VP, i.e. the lack of the subinterval property in the sense of Dowty (1979) (see for example Krifka (1989: 189 ff.), Schoorlemmer (1995) and many others). I will call classes of VP-meanings like accomplishments, achievements, activities or states **Vendler aktionsarten (V-aktionsarten)**. Accomplishments and achievements will also be called *telic VPs*. These are semantic notions covering Vendler's (1957) verb classes. As Forsyth (1970) and Comrie (1976) noted, the imperfective in English is not linked to a particular semantic distinction; it is the unmarked (morphological) aspect. For instance, under certain conditions imperfective verbs may express telicity (see Schoorlemmer (1995) for a careful discussion of this point)

A certain amount of confusion arises from the fact that the perfective aspect does not only mark a particular V-aktionsart. In addition, it licenses certain relations like inclusion of the event

time in the reference time or the anteriority of the event time with respect to the reference time. Following Klein (1994), many researchers have called these relations aspects *simpliciter* (cf. for example Kratzer (1998)). In order to avoid confusion, I intend to call these temporal relations **aspectual relations**. Typical instances are:

(77) a. $\tau(e) \subseteq I$ 'PERFECTIVE'
b. $\tau(e) < I$ 'PERFECT'
c. $I \subseteq \tau(e)$ 'IMPERFECTIVE'

Recall, however, that this terminology is confusing because we typically encounter situations like in the Slavic languages, where the perfective morphology singles out a particular aspectual class, namely the telic predicates, but licenses more than one aspectual relation, viz. $\subseteq$ and $<$ are possible. In other words, a VP with perfective morphology may either licences the PERFECTIVE or the PERFECT-relation (see Paslawska and Stechow (2001)). According to Kratzer (1998), the same is true for the simple past form in English. As evidence, she quotes an example from Abusch:

(78) Next month I will answer every e-mail that arrived.[14]

The AspP of the relative clause must have the structure $\exists e[e < I \ \& \ ARRIVE(x,e)]$, where I is modified by a semantic FUTR, i.e. the relative clause will contain a morphological past but not semantic PAST. In German, such an interpretation would be impossible for verbs in the simple past; a morphological past licences only a semantic PAST. So an English relative clause in the simple past will have two very different LFs:

(79) a. $[_{CP}\, \lambda_x$ that $[_{TP}\, PAST_7$ past $\lambda I \exists e[_{AspP}\, \tau(e) \subseteq I \ \&$ perfective ARRIVE$(x,e)]]]$
b. $[_{CP}\, \lambda_x$ that $[_{TP}\, FUTR_7$ past $\lambda I \exists e[_{AspP}\, \tau(e) < I \ \&$ perfective ARRIVE$(x,e)]]]$

The first LF is the representation of the 'ordinary' PAST-PERFECTIVE-interpretation. The second LF represents the Abusch-reading, which we may describe as FUTURE-PERFECT. The two LFs should make my distinctions clear: both representations are alike in morphological

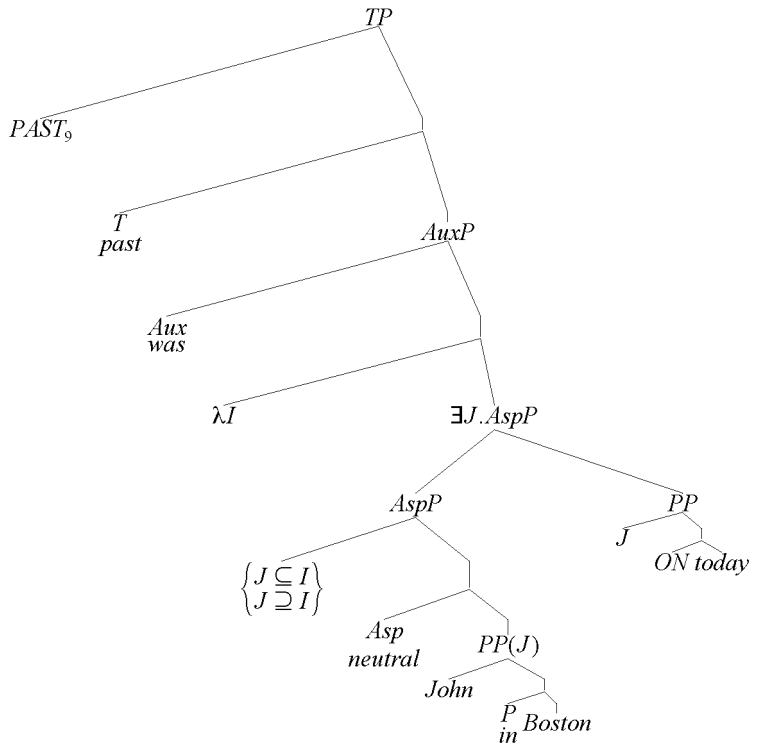
[14] My Australian informant Angela Cook finds the examples ungrammatical. According to her, one has to say 'has arrived'. On the other hand, Mats Rooth (p.c.) finds Cook's variant at the border of grammaticality. So there is dialectal variation here.

tense and aspect. Both are based on the same aspectual class. That is, the VP expresses an achievement, i.e. a telic property. But they differ in their aspectual relation (PERFECTIVE versus PERFECT) and in the semantic tense (PAST versus FUTR).

This system is largely compatible with Klein's (1994) proposal that aspects are relations between the event time (his situation time) and the reference time (his topic time). What Klein calls aspects are my aspectual relations, and the V-aktionsarten are what he calls 2-state-verbs (accomlishments/achievement) and 1-state verbs (activities/states). Klein does not link V-aktionsarten – his different types of verbs – to aspect morphology, nor does he discuss the need to distinguish morphological from semantic aspect. So, in this respect, my system is more more finely grained.

We are now in a position to treat the Bäuerle/Dowty-sentences. This is my LF for example (9b):

(80)

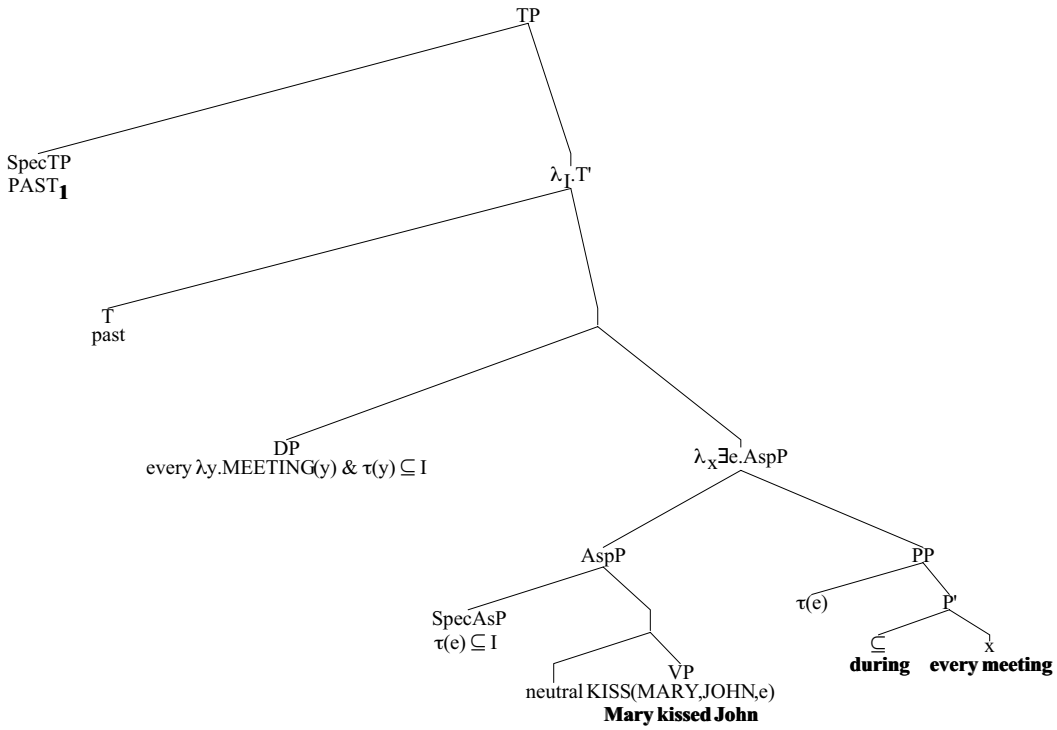


With Herweg (1990) and Katz (1997), I analyse states as properties of times. Therefore, J corresponds to the event argument of eventives. In English, states have no morphological aspect at all. This is expressed by the feature [neutral]. This feature tolerates different aspectual relations, e.g. PERFECTIVE or IMPERFECTIVE, in appropriate contexts presumably even

PERFECT. A closer inspection of the tree shows how one can have a transparent meaning for the temporal prepositions and at the same time be able to restrict the event time to the reference time. The latter is done by the aspectual relation, which is so to speak an apposition to the predicative PP, which plays the role of the VP in eventive sentences. The temporal PP modifies the event time, not the reference time, exactly as in P&F's system. This is the solution of the scope paradox exhibited by the Bäuerle/Dowty-sentences. Eventive sentences, e.g. Bäuerle's (8), are treated are treated in an analogous way, of course.

It should be obvious from these remarks that the LF (73) given in the last section is not entirely complete. My official version is the following tree:

(81)



11. TEMPORAL ADJUNCT CLAUSES AND OPERATOR SELECTION

In this section I intend to discuss in more detail the LFs of temporal adjunct clauses. P&F make the interesting point that temporal subordinating conjunctions select for different sentence determiners. For instance, **before** and **after** select the determiner **the**, whereas **whenever** selects the determiner **every**. I think the basic idea is sound, but the Geis examples that have

been discussed in section 7 make it doubtful that it is the event quantifier that is selected. The more likely option is that it is a quantifier over the event time or the reference time that is selected. I will assume this henceforth. So my LFs are inspired by P&F's treatment, but they differ from them in essential details.

Let as reconsider first the complicated example (46). I simplify it by omitting the tPP **on a Monday**, so the sentence I want to analyse is:

(82) Jane called whenever Mary arrived.

To analyse this sentence, we decompose whenever into **when** + **ever**, and we assume that **when** expresses some simultaneity relation (e.g. DURING, AT or ON). The first question we ask is whether the **when**-relation belongs to the restriction or the nucleus of the universal quantifier **ever**. The syntax suggests that the second alternative is the correct one, for we can topicalise the adjunct clause:

(83) Whenever Mary arrived, Jane called.

Nevertheless, the first alternative is worth considering as well if we want to explain that the preposition **when** selects the determiner **every**. This selection would have a natural explanation if the tPP had the structure [$_{PP}$ **when** [$_{CP}$ **ever Mary arrived**]], where the CP is an object of the preposition **when**. The interpretation would then proceed in analogy to the tPP **on every Monday**. The fact that **whenever** is moved together with the topicalised sentence is explained if we assume that **whenever** is the phonological realisation of the semantically distinct parts **when** + **ever**.

Whichever alternative will eventually turn out to be the correct one, it is important to realise that the reference time of the main clause cannot be the time denoted by the semantic main tense PAST in cases like this one. This becomes obvious if we choose an activity or state as aktionsart for the main clause. I am indebted to Magdalena Scheiner for having pointed this out to me.

(84) Whenever Jane called, Mary was playing tennis.

Suppose we did analyse this sentence along the lines of the following paraphrase:

(85) *For every time in $PAST_7$ which minimally includes a call by Jane, there is a

simultaneous time in which $PAST_7$ is included and which is a playing of tennis done by Mary.

This analysis entails that a single activity of playing tennis done by Mary covers each call done by Jane in the reference time $PAST_7$. While this scenario is possible, it is by no means the most plausible one. The unmarked reading is about several activities of playing tennis performed by Mary, one for each call. So what has gone wrong? Obviously, the condition that the event time of the main clause includes "the reference time" $PAST_7$ cannot be maintained. There is no particular reference time for the main clause in this case: the relevant time variable is bound by the generalised quantifier expressed by the subordinate clause. So a better paraphrase of the intended meaning is the following one:

(86) For every time in $PAST_7$ which minimally includes a call by Jane, there is a simultaneous time in $PAST_7$ in which the first time is included and which is a playing of tennis done by Mary.

Using a logical formula, we can make this reading more precise:

(87) $\forall I[I \subseteq PAST_7 \ \& \ \min(\lambda J \exists e[e \subseteq J \ \& \ CALL(JANE,e)])(I) \rightarrow \exists K[K \subseteq PAST_7 \ \& \ K \ WHEN \ I \ \& \ \exists S[K \subseteq S \ \& \ PLAYING\_TENNIS(MARY,S)]]]$

The bound variable that corresponds to the reference time is K, and the IMPERFECTIVE "$\subseteq$" connects the event time S of the main clause with K, which co-varies with the quantifier $\forall$I.

If the **when**-information belongs instead to the nucleus of the **ever**-determiner, we have to analyse the sentence according to the following paraphrase:

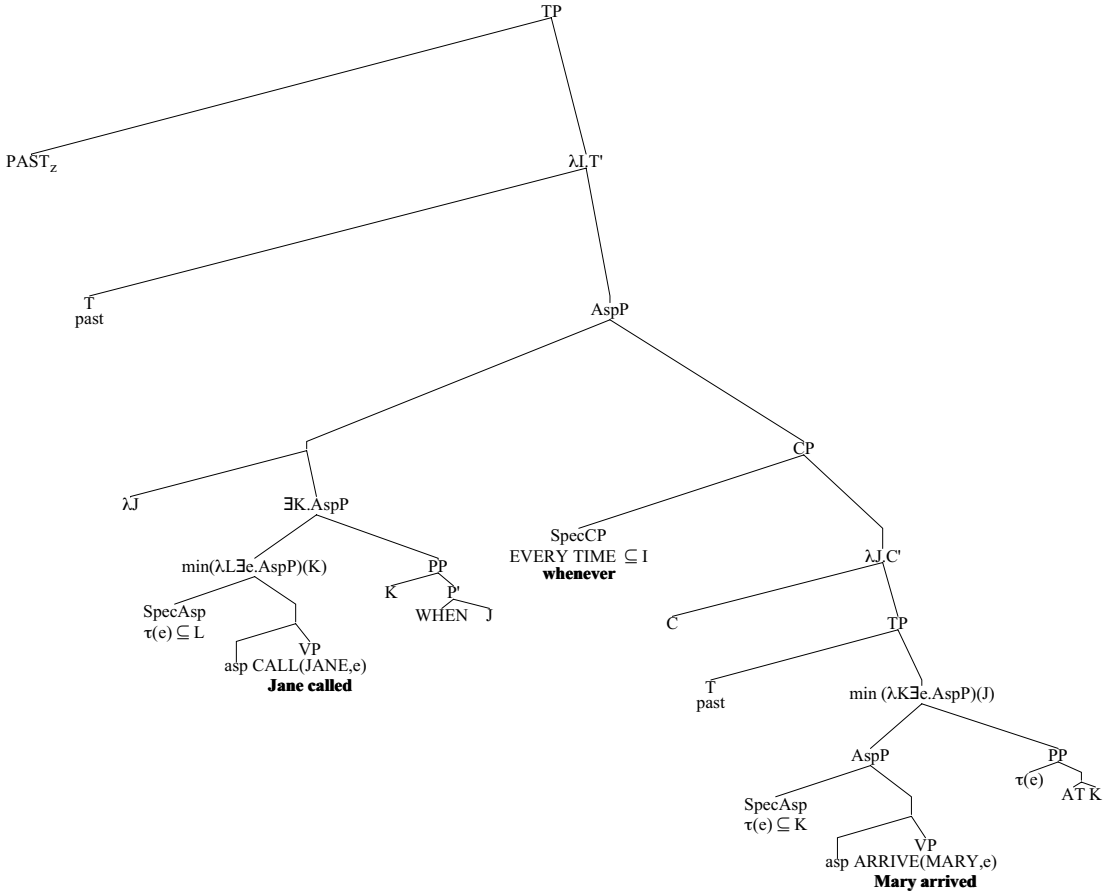
(88) For every time in $PAST_7$ which is simultaneous to some time that minimally includes a call by Jane, there is a time in $PAST_7$ in which the first time is included and which is a playing of tennis done by Mary.

I don't see that the two readings are truth-conditionally different, but the second option clearly is the right choice for sentences of the kind illustrated by the following example, which is in accordance with the classical assumption that a when clause restricts an adverb of quantification (cf. Lewis (1975) among many others).

(89) Mary was always playing tennis when Jane called.

For the time being, let us analyse example (83) in analogy to paraphrase (86), which is a case of Quantifying into tPP.

(90)



The details are open to dispute, of course. But the overall architecture is clear enough: **whenever** is (semantically) decomposed into WHEN + EVERY TIME, the first being a temporal preposition expressing a sort of simultaneity with the complications known since Heinämäki (1974).[15] The EVERY-part is a determiner that forms a nominal out of a temporal property formed by abstraction over the event time. This GQ is QR-ed out of the PP adjoined to the main AspP.[16] It is interesting to note that the logical syntax almost makes it obligatory for

[15] The semantics has to make sure that EVERY TIME(I) can map a property of times into a generalised quantifier. It is obvious how to do this.

[16] G. Katz asks how this sentence is related to **Every time Mary arrived, John called**. The LF of this is

PAST$_1$ λI[**every time Mary arrived** λx∃e[$_{AsP}$ e WHEN x & CALL(JOHN,e) & τ(e) ⊆ I]],

the tense of the subordinate clause to be semantically empty. The quantifier EVERY TIME is restricted by the semantic main tense. We could introduce the semantic tense $PAST_7$ in the subordinate clause if we wanted, but we would have to move it in front of CP, thereby creating the movement index λI, which seems rather artificial.

I leave it to the reader to verify that sentences of the type exhibited by example (84) can be formalised along the same lines.

Next let us return to **after**. One of the problems the present approach can solve is that in German (and presumably some variants of English[17]), the conjunction 'after' (Germ. **nachdem**) selects a perfect but seems to ignore it semantically.

(91) Jane rief an, nachdem Marie angekommen war/*ankam.
Jane called, after Mary arrived was/*arrived.
'Jane called after Mary (had) arrived.'

The subordinate clause has the structure AFTER PAST PERFECT VP, but it does not denote a time which is after a time after an arrival of Mary. Rather, it denotes a time that is after an arrival of Mary. The formal analyses of **nachdem** that are known to me skip over that point without comments (Herweg (1990), Musan (2000)). The approach advocated here has no problem. The embedded sentence can have a pluperfect and the operator in SpecCP can nevertheless bind the event time. The formula representing the reading in question is this:

(92) $\exists e[\tau(e) \subseteq PAST_1$ & CALL(JANE,e) & $\tau(e)$ AFTER **the** min $\lambda J[(\exists e'[\tau(e') < PAST_1$ & ARRIVE(MARY,e') & AT(e',J)])]

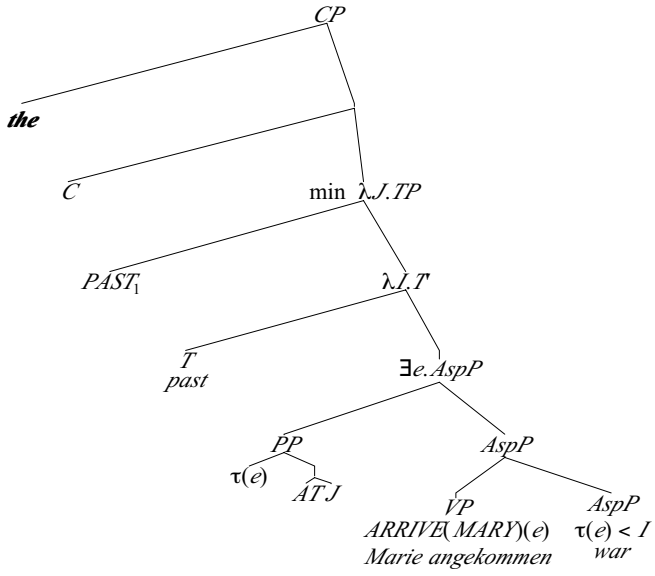
The overall structure is as in (90). For convenience, the structure of the adjunct clause is given below.

(93)

where the complex NP **time Mary arrived** is analysed as

$(\lambda x[TIME(x)$ & $x \subseteq I] \cap \min \lambda J[PAST_1 \lambda I \exists e[ARRIVE(MARY,e)$ & $\tau(e) \subseteq I$ & $\tau(e) \subseteq J]])$.

[17] Sauerland (2001)



The formula (92) is obtained by reconstruction of the extraposed subordinate clause to its base position. It is assumed that the definite CP-term occupies the object position of AFTER.

It is interesting to compare this LF with the simpler English construction:

(94) Jane called after Mary arrived.

which is analysed in analogy to (90) and which has the reading

(95) ∃e[τ(e) ⊆ $PAST_1$ & CALL(JANE)(e) & e AFTER **the** min λJ∃e'[τ(e') ⊆ $PAST_1$ & ARRIVE(MARY,e') & τ(e') AT J]]

Both LFs speak about the same reference time, but there is an 'aspectual' difference: in (95) the arrival is located in the reference time $PAST_1$, but in (92) the reference time is after the arrival, which is due to the presence of the PERFECT in the subordinate clause. Truth-conditionally, the two constructions are equivalent. I don't see how the German construction can be treated in P&F's system.

I leave it to the reader to develop the precise tree for the Geis sentences in (63) and (64).

12. OVERT QUANTIFYING IN WITH PIED-PIPING

Languages like German and Hungarian have movement rules like Scrambling and (multiple) Topicalisation that can be interpreted as QR. Here we can find typical 'inverse linking'

configurations that we would expect in a quantifying in approach. A complication comes from the fact that there is no preposition stranding in German. So the entire PP is scrambled, and we obtain an S-structure where the quantifiers are where we would expect to find them but the prepositions are in the wrong places. I will demonstrate this for the following example:

(96) Wolfgang hat während des letzten Sommers in keinem Monat an jedem Sonntag Tennis gespielt.
Wolfgang has during the last summer in no month on every Sunday tennis played.

'For no month last summer did Wolfgang play tennis every Sunday.'The sentence has the following transparent LF:

(97) $PAST_1$ λI[**the**(λz[LAST-SUMMER(z) & τ(z) ⊆ I])(λz[**no**(λy[MONTH(y) & τ(y) ⊆ I & y DURING z])(λy[**every** (λx[SUNDAY(x) & τ(x) ⊆ I & x IN y])(λx∃e[e ON x & τ(e) ⊆ I & PLAY-TENNIS(e)])])])]

The LF exhibits the typical inverse linking configuration because it is generated from the following D-structure by QR-ing the DPs such that their relative scope is spelled out:

(98) [$_{PP}$ an jedem Sonntag [$_{PP}$ in keinem Monat [$_{PP}$ während des letzten Sommers]]] Wolfgang
on each Sunday in no month during the last summer Wolfgang
Tennis gespielt hat
tennis played has

The result of the movement operations is a configuration that determines the wanted LF if we add some further indices and a bit of logical glue along the lines discussed on the previous pages.

(99) [des letzten Sommers]$_3$ [keinem Monat während t_3]$_2$[jedem Sonntag in t_2]$_1$ [an t_1] Wolfgang
the last summer$_3$ [no month during t_3]$_2$ [every Sunday in t_2]$_1$ [on t_1] Wolfgang
Tennis gespielt hat
tennis played has

Unfortunately, this is not what the German surface syntax gives us. We can scramble the quantifiers, but we cannot scramble out of a PP, i.e. we have to carry the preposition of a PP

along with the scrambled DP that is the object of the preposition. Let us adopt Chomsky's (1995) Copy+Deletion-theory for pied-piping in order to see what is going on. First we leave an indexed copy for each moved phrase:

(100) Syntactic derivation of SS (Pied-Piping of PP)

an jedem Sonntag in keinem Monat während des letzten Sommers Wolfgang Tennis gespielt hat

[*an jedem Sonntag in keinem Monat während des letzten Sommers*]$_1$[*an jedem Sonntag in keinem Monat während des letzten Sommers*]$_1$ Wolfgang Tennis gespielt hat

[*in keinem Monat während des letzten Sommers*]$_2$[an jedem Sonntag [*in keinem Monat während des letzten Sommers*)]$_2$]$_1$[an jedem Sonntag in keinem Monat während des letzten Sommers]$_1$ Wolfgang Tennis gespielt hat

[*während des letzten Sommers*]$_3$ [in keinem Monat [*während des letzten Sommers*]$_3$]$_2$[an jedem Sonntag [in keinem Monat während des letzten Sommers]$_2$]$_1$[an jedem Sonntag in keinem Monat während des letzten Sommers]$_1$ Wolfgang Tennis gespielt hat

At each step, the moved phrase and its copy are written in italics. The rules that interpret these structures at LF and PF (= phonetic form) are now the following ones:

(101) PP-Pied Piping: Given the chain α_i, β_i, α and β are PPs of the form $\alpha = \delta\ \gamma$ and $\beta = \delta'\ \gamma'$ respectively, where δ and δ' are prepositions and γ and γ' are DPs.

a. LF: Rewrite the head of the chain as $\gamma\ \lambda i$ and the tail as $\delta'(i)$.

b. PF: Pronounce the head and do not pronounce the tail.

The PF-rule is an instance of what Klein (1993) has called P-deletion ('phonetic deletion'). See also Bobalijk's (1999) for PF-rules of this kind. When we start to apply the rule of construal (101a), the head and the tail of each chain are the same, i.e. $\alpha_i = \beta_i$. But each rewriting step changes the input for the next application, and the rule applies successively until no further application is possible.

Here is an illustration of how the quasi-LF (99) is generated from the S-structure generated in (100). For convenience, I have written the relevant head and tail at each step in italics.

(102) Derivation of (99)

[während des letzten Sommers]$_3$ [in keinem Monat *[während des letzten Sommers]$_3$*]$_2$[an jedem Sonntag [in keinem Monat während des letzten Sommers]$_2$]$_1$[an jedem Sonntag in keinem Monat während des letzten Sommers]$_1$ Wolfgang Tennis gespielt hat

→[des letzten Sommers] λ_3 [in keinem Monat *während(3)*]$_2$[an jedem Sonntag [in keinem Monat während des letzten Sommers]$_2$]$_1$[an jedem Sonntag in keinem Monat während des letzten Sommers]$_1$ Wolfgang Tennis gespielt hat

[des letzten Sommers] λ_3 *[in keinem Monat während(3)]$_2$*[an jedem Sonntag *[in keinem Monat während des letzten Sommers]$_2$*]$_1$[an jedem Sonntag in keinem Monat während des letzten Sommers]$_1$ Wolfgang Tennis gespielt hat

→ [des letzten Sommers] λ_3 [keinem Monat während(3)] λ_2[an jedem Sonntag *in (2)*]$_1$[an jedem Sonntag in keinem Monat während des letzten Sommers]$_1$ Wolfgang Tennis gespielt hat

[des letzten Sommers] λ_3 [keinem Monat während(3)] λ_2*[an jedem Sonntag in (2)]$_1$[an jedem Sonntag in keinem Monat während des letzten Sommers]$_1$* Wolfgang Tennis gespielt hat

→ [des letzten Sommers] λ_3 [keinem Monat während(3)] λ_2[j*edem Sonntag in (2)* λ_1 *[an (1)]* Wolfgang Tennis gespielt hat

And here is an illustration of the application of the PF-rule, which is much simpler:

(103) Generating the PF:

[während des letzten Sommers]$_3$ [in keinem Monat *[während des letzten Sommers]$_3$*]$_2$[an jedem Sonntag [in keinem Monat während des letzten Sommers]$_2$]$_1$[an jedem Sonntag in keinem Monat während des letzten Sommers]$_1$ Wolfgang Tennis gespielt hat

→ [während des letzten Sommers] [in keinem Monat]$_2$[an jedem Sonntag [in keinem Monat während des letzten Sommers]$_2$]$_1$[an jedem Sonntag in keinem Monat während des letzten Sommers]$_1$ Wolfgang Tennis gespielt hat

[während des letzten Sommers] *[in keinem Monat]$_2$*[an jedem Sonntag *[in keinem Monat während des letzten Sommers]$_2$*]$_1$[an jedem Sonntag in keinem Monat während des letzten Sommers]$_1$ Wolfgang Tennis gespielt hat

→ [während des letzten Sommers] [in keinem Monat] [an jedem Sonntag]$_1$[an jedem Sonntag in keinem Monat während des letzten Sommers]$_1$ Wolfgang Tennis gespielt hat

[während des letzten Sommers] [in keinem Monat] *[an jedem Sonntag]$_1$[an jedem Sonntag in keinem Monat während des letzten Sommers]$_1$* Wolfgang Tennis gespielt hat

→ [während des letzten Sommers] [in keinem Monat] [an jedem Sonntag] Wolfgang Tennis gespielt hat

There certainly are other technical possibilities for obtaining these results, but something along these lines seems correct. If this is so, then we are forced to the rather abstract syntax I am advocating here. In particular, P&F's account of tPPs is not applicable to German as it stands because no Quantifying into tPPs is possible there. Quantifying in, however, is crucial to obtain the correct results.

In languages with 'free word order' like Hungarian, the order of tPPs is more or less the same as in German:

(104) Hungarian[18]

[18] I am indebted to Gergely Pethö for the example.

Wolfgang múlt nyár-on egyik hónap-ban sem teniszez-ett minden vasárnap
W. last summer-in any month-in NEG tennis-play-past every Sunday-Nom
'For no month last summer did Wolfgang play tennis every Sunday.'

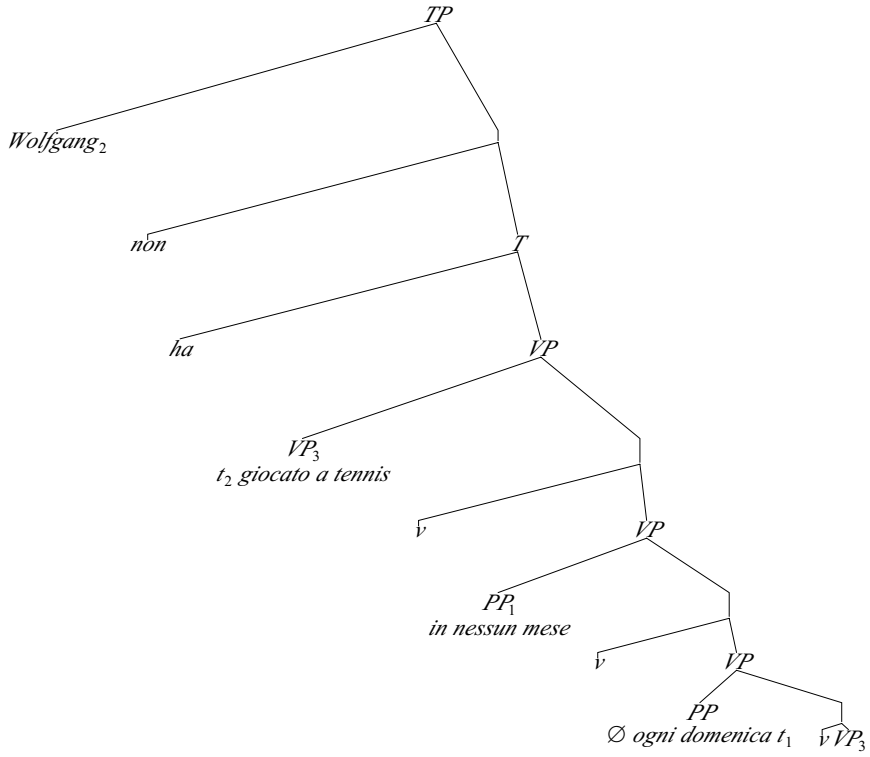
The word order of the temporal adverbials is like in German in these languages. For Hungarian this is not surprising, because we have preverbal TOP-positions which can be treated more or less like German scrambling (cf. Kiss (1987)). The construction is complicated, but runs along the lines of the German example.

The harder cases are 'configurational' languages like Italian and English. Here the adverbs are in post verbal position and still exhibit the same word order. If we did generate the adverbs in analogy to German post verbally, we would expect the mirror image of the adverbs, a well-known puzzle of adverb theory (cf. Pesetsky (1995), Ernst (1998)).

(105) Italian:
L'estate scorsa Mario non ha giocato a tennis in nessun mese ogni domenica.
The summer past M. not has played tennis in no month every Sunday.

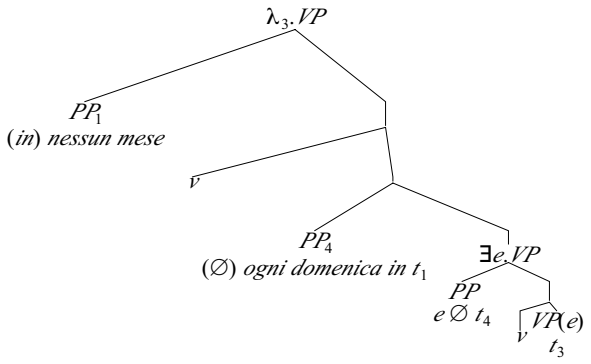
In Cinque (1999: p. 30) we find an interesting speculation that the tPPs (his circumstantial phrases) are perhaps generated preverbally with a successive movement of the VP to the finite position. Ignoring the topicalised constituent, Cinque's structure for the example could be as follows:

(106)



Following Chomsky (1995), Cinque assumes 'VP-shells', which contain the tPPs. The VP moves to the highest SpecVP at Spell-Out. At LF, the VP is reconstructed. If we accept this structure, we have to make sure that the two PPs are 'linked' in the correct way, as indicated by the indices. We have to interpret the lower PP as if it were **ogni domenica in t_1** 'every Sunday in t_1'. We don't have to think of the relation between the two PPs as syntactic movement, but semantically it comes to this: we have to quantify **nessun mese** 'no month' into a PP that restricts the lower NP-head, viz. **domenica**. In other words, the more elaborate LF for the complex VP is shown below:

(107)



I have to add that **nessun mese** is a negative polarity item (NPI), which means 'a month' (cf. Blaszczak (2000), Penka (2001)).

Something like this would seem to me to be correct. Perhaps the relation between t_3 and the VP is not movement in the literal sense, and we can generate the two tPPs as a complex adjunction structure to the right of the verb, i.e. we generate the surface structure:

(108) Wolfgang ha giocato a tennis [in nessun mese [∅ ogni domenica]]
Wolfgang has played tennis in no month every Sunday

Semantically, however, the complex adverbial must be something like (107), i.e. we need a VP-variable as the head of the adverbial. After all, we know from categorial grammar that an adverbial is a structure with a VP-gap (see for example Montague (1973)).

The English example (109) can be analysed similarly to the Italian example. The main difference is that we have to topicalise the complex PP **for no month last summer**.

(109) For no month last summer did Wolfgang play tennis every Sunday.

It is interesting that the relative order of the quantifiers is as we want them to be at LF. If we do reconstruct the topicalised PP to its D-structure position, the relative order is reversed.

(110) ---- did Wolfgang play tennis [PP ∅ every Sunday **[pp for no month [PP ∅ last summer]]**]

We could QR the two NPs and obtain the same result as for Italian. It would be nicer if we could interpret the topicalised PP by means of QR. The only problem that has to be solved for

such an approach is that the context variable I contained in **last summer** must be bound by the PAST tense. In other words, the semantic tense could be introduced at the CP level only. The result would be something like this:

(111) $PAST_5$ λI[[~~**for**~~ **no month** ~~OF~~ **last summer** ⊆ I] λ_2 **did** [**Wolfgang play tennis**] λP[[**every Sunday** for t_2] λ_1 $\exists_e$[P(e) & τ(e) ⊆ I & e ON t_1]]]

13. CONCLUSION

My proposal keeps the basic insight of P&F that semantic tense, notably PAST, restricts a time variable contained in the restriction of a temporal quantifier. (I have argued that eventive verbs have no time variable in their lexical entry. This variable is introduced by an aspectual relation, e.g. PERFECTIVE, PROGRESSIVE or PERFECT. The time variable is not bound by a tPP but by the semantic tense of the sentence. This seems necessary for getting the selection of pluperfect by **nachdem** 'after' right. But perhaps there is another explanation for the selection restriction, and that particular issue is not so important.)

The architecture of grammar defended in this article is rather different from that assumed by P&F in so far as I crucially assume Quantifying into tPPs. If we try to describe the facts discussed in the style of P&F without any movement rules, we face a serious problem of expressive power. Consider a simplified version of the German example (1), which is worded in English for convenience:

(112) Wolfgang in no month on every Sunday tennis played (S-structure)

Recall that the inverse linking configuration needed for the semantic interpretation is the following:

(113) $[_{NP2}$ no month$]_2$ $[_{NP1}$ every Sunday $[_{PP2}$ in $t_2]]_1$ $[_{PP1}$ on $t_1]$ VP (LF)

I cannot see that this configuration can be described in a non ad hoc way without the rule QR. The reason is that the rules of PP-formation that P&F allow are too local. If we assume the simple semantics for temporal prepositions stated in section 8, the relevant semantic rules of P&F are these:

(114) a. PP-to-VP-Adjunction: $|| [_{VP}$ PP VP] || = λI[|| PP ||(I) = 1 & || VP ||(I) = 1]

b. PP-to-N-Adjunction: $\| [_{N'}\ N\ PP] \| = \lambda I[\| N \|(I) = 1\ \&\ \| PP \|(I) = 1]$

c. PP-Formation: $\| [_{PP}\ P\ NP] \| = \lambda I[\| NP \|(\lambda x[\| P \|(x)(I) = 1])]$

I see no way to structure the surface structure (112) so that the reading represented by (113) comes out. We obtain nonsense for every structuring. If this argument is correct, then no simple surface grammar for these constructions is possible; a movement approach is necessary, at least in languages such as German or Hungarian. Configurational languages such as English or Italian seem to adopt a different strategy. The quantifiers may exhibit the correct configurations, but the VP must be moved. I understand these facts even less than those of German, and I cannot offer a typology so far.

An interesting speculation is that the distribution of the type of temporal adverbs considered in this article are restricted by Chomsky's theta-criterion (1981): the time argument of the verb is modified by exactly one temporal adverb, which may be modified by other temporal adverbs. Only the highest modifier would be restricted by the semantic tense. This speculation is not compatible with what I have been saying about the accessibility of the time variable introduced by the ASPECT-relation, but it is in the spirit of P&F's approach, and it might turn out to be the correct view after all.

I have to add that certain adverbs of duration (e.g. **since last summer**, **until next Thursday**, **for ten years, in two days**) behave rather differently from the type of temporal adverbs considered in this paper.[19] So it is an oversimplification of speaking of tPPs without qualification. The claims of this paper are valid only for tPPs which take quantifiers as objects.

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[19] See Stechow (2002).

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