

Temporality and Strict Lexicalism

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1. Introduction

Tense is marked morphologically (in many languages), which suggests that it might be introduced lexically, while its semantic analysis requires that it be assigned wider scope than other temporal elements, in particular duratives and frequentatives. This means that any attempt to treat tense marking in the lexicon must provide for the later "quantifying in" of temporal adverbials—even though such adverbials are optional and iterative modifiers. The only likely formulation of such a rule is either semantically noncompositional and very awkward to state, or else completely inadequate. A rule introducing tense as a feature on verb phrases (or sentences) avoids all of these problems; it is compositional, simple to formulate, and entirely adequate to the scope problem. Moreover, its adoption needn't signal the abandonment of all constraints on the interaction of morphology and syntax. The treatment formulated below obeys Brame's spelling prohibition: there are no late rules which "spell out" morpheme combinations.

The proposal does require that syntactic rules be allowed to introduce morphological features—in particular, the features marking the tenses of finite verbs—in violation of (strict) Lexicalism, at least as this has been formalized in the Generalized Lexicalist Hypothesis (GLH):

(GLH) No syntactic rule can refer to an element of morphological structure.

The significance of this violation is that it suggests a division of elements of morphological structure—into those inflectional elements to which syntactic rules may refer, and those derivational elements to which they may not. The treatment of temporality proposed here provides syntactico-semantic grounds for retaining the derivational/inflectional distinction in morphology. Furthermore, the treatment suggests means of capturing other aspects of the inflectional/derivational distinction.

2. The Scope of Tense and Duratives (and Frequentatives)
Duratives assert that a proposition holds throughout a specified period of time. For example, the durative adverbial in (1), for hours, asserts that the sleeping took place throughout a period lasting hours.

(1) They slept for hours

The semantics of the for hours phrase may be formalized as in (2):

(2) for all models A, propositions p, speech times s, event times e, and reference times r:
 $A_{s,e,r} \vdash \text{for-hours}(p)$ iff \exists l. e is at least two hours long
 and 2. $\text{Vice } A_{s,i,r} \vdash p$.

where for-hours' is the meaning of for hours. 1) 2)

The universal quantifier in clause (2) in the definition in (2) expresses the requirement that the sleeping went on throughout the period lasting hours. This is a necessary part of the semantic rule: we simply don't allow that sleeping has gone on for hours if it has only gone on for a few minutes of a period lasting hours. If the meaning of the past tense is simply that the proposition is asserted to hold before the time of speech, then the relative scope of tense and durative in (1) is immaterial. A past time which is two hours long is a two-hour long time each of whose subintervals is past, and vice versa.

Less simple tenses cannot be commuted with the durative operator without changing semantic value, however. For example, all tenses with the meaning 'not completely past and cannot commute with durative operators without changing truth value. To illustrate this, consider the English Perfect, which holds only of intervals which are not completely past—the ones McCoard (1978) refers to as "extended nows." We can provide a rough formalization of this:

(3) $A_{s,e,r} \vdash \text{PERF}(p)$ iff 1. e ends at s and
 2. $A_{s,e,r} \vdash p$

which we can employ in testing for the proper scope relationships. These are plain in sentences such as (4):

(4) He has worked here for a year

Suppose that tense were analyzed as having narrower scope than the durative. We would then predict the truth conditions derived in (5):

- (5) $A_{s,e,r} \vdash \text{for-a-year}'(\text{PERF}(\text{be-work-here}')) \text{ iff}$
 1. e is at least a year long
 2. $\text{Vice } A_{s,i,r} \vdash \text{PERF}(\text{be-work-here}')$
 ---and (2) iff
 (2') $\text{Vice } 1. i \text{ ends at } s \text{ and}$
 2. $A_{s,i,r} \vdash \text{be-work-here}'$

But obviously (2') will never be satisfied since some subintervals must end before speech. Since (4) isn't contradictory, (5) is clearly the wrong formulation of its truth conditions. If we suppose, however, that duratives have narrower scope than tense, then correct truth conditions may be derived straightforwardly:

- (6) $A_{s,e,r} \vdash \text{PERF}(\text{for-a-year}'(\text{be-work-here}')) \text{ iff}$
 1. e ends at s and
 2. $A_{s,e,r} \vdash \text{for-a-year}'(\text{be-work-here}')$
 ...and (2) iff
 (2') 1. e is at least a year long and
 2. $\text{Vice } A_{s,i,r} \vdash \text{be-work-here}'$

This indicates that duratives ought to be analyzed as having narrower scope than tense. The same sort of argument establishes that frequentatives likewise have narrower scope. The argument is based on sentences such as (7):

- (7) He has worked here several times

and the observation that (7) cannot possibly be analyzed as true iff each instance of his working here is required to be an "extended now."

These results are not of immediate interest to the lexical analysis of English because the English Perfect is composed of two words—a participle and an auxiliary. It is conceivable that the scope relationships could be handled syntactically, and that there would be no requirement that these syntactic rules make illicit reference to elements of morphological structure.³⁾ Other languages are less tractable, however, because they represent the same noncommutative meanings with morphologically marked tenses.

The German Present tense is morphologically marked and has a nonpast meaning. As (8) indicates, duratives must be regarded as having narrower scope than tense in German:

- (8) Morgen wohnen wir fuerf Jahre hier
 tomorrow live-PRES we five years here
 'As of tomorrow we'll have lived here five years'

The Russian Future Imperfective is only morphologically marked in the verb *bit'* and it likewise allows a nonpast meaning. As (9) indicates, duratives must be regarded as having narrower scope than tense in Russian as well:

- (9) K subbote ja budu zd'es' uže celyx
 by Saturday I be-FUT here already whole

p'at' let
 five years

'As of Saturday I'll have been here for five years'

To sum up: there are therefore some morphologically marked tenses which must be assigned wider scope than temporal adverbials.

3. The Grammar of Tense and Time Adverbials

Although there might be any number of formalizations of the grammar of temporalis and morphological tense, they will all do one of two things. Either the treatment introduces the various tenses at the verb level, or it does not, but instead finds some mechanism of introducing the various tenses at a higher level. Every framework faces this decision. The choice depends both on semantic scope relationships and on the shape of tense marking in a particular language. For example, if tense were marked with a sentence or VP adverb in some language, no one would feel compunction about introducing tense at that level. In a language such as German (or Russian or English), however, where tense is marked morphologically, one would be inclined much more toward a treatment of tense as a lexical category—a feature of, or an operation on, words. Such a lexical treatment might have the virtue of allowing the free generation of tense syntactically, but it will nonetheless be attacked here.

The strategy has a serious limitation. To be exact, I argue for a somewhat more general conclusion: in any semantically compositional framework tense must be introduced at the VP level (or later), barring the use of structures intermediate to syntactic constituent structure and semantic interpretation.

To see this, let's formulate a tensing rule for a nonpast tense which operates on lexical items—verbs. Since the rule is to preserve the degree of semantic compositionality which Bach (1976) terms the rule-to-rule hypothesis, we require that a model-theoretic interpretation be assigned to the constituent admitted by these rules. In order to illustrate the problem concretely, we'll examine one such rule, viz. that introducing the German Present.

- (10) for V an intransitive verb, $V_{[+pres]}$ is likewise an intransitive with the meaning $?(V')$, where V' is the meaning of V.

Let us suppose moreover that the meaning of the Present tense can be appropriately rendered by a tense logical constant 'PRES.' We should therefore represent the meaning of the output of (10) in the following way:

$$(11) \lambda x \text{PRES}(V'(x)) \quad (= ?(V') \text{ in (10)})$$

The difficulty arises in consideration of duratives (or frequentives). As noted above, these elements must be assigned narrower scope than tense (in some languages). But both duratives and frequentives are VP modifiers, as shown by their optionality, their iterativity, and by the fact that they don't change the category of phrases to which they're added (they are added to well-formed VP's to create well-formed VP's). This suggests the following sort of rule for duratives:

(12) a durative DUR may be added to a VP with the meaning VP' to obtain a VP with the meaning $\lambda x \text{DUR}'(VP'(x))$

This rule cannot possibly be right, however. The VP' to which the DUR' has been added already contains a tense operator, courtesy of (10). The combination of (10) and (12) will assign wider scope to duratives than to tense. It is moreover unclear how to reformulate (12) in any semantically coherent way. Any attempt to provide a correct semantics in (12) will have to be able to reach within the Present tense operator in (10) and will thus be noncompositional. Nor can the formulation of the non-compositional rule be straightforward. We could not e.g. simply write: find the tense operator in the VP and insert the durative operator immediately to its right. Nor could we simply look for the first such operator—there may be more than one, as in the case of a conjunction:

(13) ...dass sie lange sangen und tanzten.
 COMP they long sang and danced
 '...that they sang and danced for a long time'

The required formulation is clear enough: the durative operator must be inserted immediately to the right of the tense operator(s) associated with the main verb(s) of the verb phrase. The rule is thus not only noncompositional, but it requires as well that (some) syntactic features be retained in the semantic interpretation (viz. an indication of which verb(s) are main verb(s)). This is an unlikely looking violation of the principle of autonomy of components.

One solution to this problem would be to postulate a level of structure between syntactic constituent structure and semantic composition. This might be the level of "functional structure" in Lexical Functional Grammar (LFG), for example. Halvorsen (ms) presents a semantics for LFG which composes model theoretic

interpretations from functional structures (once these have been composed from syntactic phrase structures). Tense is factored out of verbs in functional structure (Halvorsen (ms: 2-3)), so that there should be no difficulty in accounting for the correct interpretations of tense even if one treated tense as a verb operator, in LFG. Another variant of this solution may be found in LaPointe (1979), who employs a level of "logical form," which similarly mediates between syntactic structure and semantic composition. The question to be pursued here is whether one can assign the correct interpretation without using an additional level of structure.

A different attempt at a solution might reanalyze the offending adverbials as complements to the verb rather than VP modifiers. Couldn't duratives be reanalyzed as required complements for whom a place would automatically be held in semantic interpretation, so that the scope relations could be an automatic consequence of the lexical meaning of the verb?

At first blush one might very well think so. For the sake of precision, let's sketch this proposal in more detail. Briefly, it foresees that a verb will be subcategorized to take, in addition to its customary nominal or adverbial complements, at least one temporal adverbial. Perhaps the simplest way to implement this would be to introduce a category of "atemporal VP," to which a temporal adverbial must be added to obtain a standard VP. There must of course be a zero element in each category, so that we may regard the complements as present even while they remain inaudible. The semantics of the basic verbs (and VP's built up from them) would also have to be adjusted. In place of the n-place predicates which up until now have been associated with basic verbs, we should, for each such predicate, define an n+1-place predicate, with the new place reserved for a temporal adverbial. Suppose for example that for every n-place predicate v associated with a basic verb, we define an n+1-place v_T with the following semantics:

$$(14) A_{s,e,r} \vdash v_T(x_0)(x_1) \dots (x_n) \text{ iff} \\
 A_{s,e,r} \vdash x_0(v(x_1) \dots (x_n))$$

Note that this effectively gives elements of the complement category (interpreted by x_0 above) narrower scope than all other temporal elements—since the others will be added as sentence operators to atomic sentences such as $v_T(x_0)(x_1) \dots (x_n)$.

Tense could then be added via a rule on lexical verbs. (This relinquishes the free generation of tensed forms, but it retains a lexical treatment. I don't see how a pure "free generation" treatment could work.) The required scope relations could be realized in this way. This would have been achieved, however, at the cost of the introduction of new semantical apparatus, the predicates 'v_T' and new syntactic mise en scene, the null realization of indefinite temporal adverbials (to account for the

optionality of these adverbials once they have been given the status of complements). In addition, since we analyze optional adverbials as complements, we can no longer regard optionality as proof of modifier status. Thus an interesting empirical claim has been relinquished as well.

If this were not enough to bias one against the analysis of tense as a verb operator, rather less tractable problems arise when one considers the iterability of these temporal adverbials. Duratives and frequentatives are not limited to a single occurrence per clause as the complement analysis above might suggest. The English phrase for an hour three times a week for four months shows an iteration of duratives, as do the following phrases from German:

(15) Schon zwei Jahre besucht er uns jede Woche eine Stunde
 already 2 years visit he us every week one hour
 'He has visited us an hour every week for two years'

Er hat uns zweimal eine Woche lang jeden Tag
 he AUX us two-times a week long every day
 vier mal angerufen
 four time call

'He's called us four times a day for a week twice'

Even a single iteration is an irreparable embarrassment for the view that these are complements. Iteration is not only regarded as uncharacteristic for complements, it presents formidable technical problems as well. Since complements do not in general iterate, the admission of one iterable category would require a split in syntactic treatments—one for standard complements, one for iterables. We work ourselves into a semantic cul de sac as well because the addition of a temporal adverb to a verb should, under the complement view, yield a unique predicate—just as every function should yield a unique value when applied to a particular argument. But applying the function represented by the verb *besuch-* to its putative durative argument seems to yield two functions—one which takes an NP argument to form a proposition, and one which takes the NP argument and a frequentative argument (and possibly another durative and then possibly still another frequentative argument). There isn't a recognizable sense in which this could be regarded as functional application.

Another way to ensure the proper interpretation of duratives and frequentatives vis-a-vis tense would be to introduce a special temporal index to which the semantic rule for duratives (or frequentatives) could refer. This would amount to treating these adverbials as deictics—and might be felt to be in keeping with the spirit of recent work in temporal analysis which makes extensive use of deixis, e.g. Enc (1981). While this move would be technically adequate to saving the analysis of tense as a verb operator, it would be hard pressed to account for how such para-

eters might be contextually available for use in the interpretation process. One simply cannot argue that "the times to which duratives might refer" are available (through contextual prominence or whatever) in the way that e.g. speaker, hearer, speech time, and reference time are. (A distinct index would be required for frequentatives, apparently, while the treatment of sentences with iterated adverbials, such as (15), might even require several distinct novel indices.) The deictic interpretation of these temporal expressions would raise many more difficulties than it would solve.

There seems not to be any plausible way of salvaging the analysis of tense as verb operator.

The analysis of tenses as verb operators looks even worse when one considers that there is a straightforward syntactic treatment of the scope relations between tense and duratives. We write rules so that VP's are first built up without tense ([-fin]). Duratives and other elements with scope narrower than tense are then attached via rules which operate exclusively on untensed VP's (in this case, simply those marked [-fin]). Tense-introducing rules change the features of the VP's to [+fin], ensuring that duratives etc. cannot be subsequently introduced. In each case, the semantics associated with the rules simply attaches an appropriate operator, so that the meaning of the derived rule is simply $\lambda x \text{OPERATOR}'(\text{VP}'(x))$, where VP' is the meaning of the input constituent. Below is a formulation of the required rules for German in Generalized Phrase Structure Grammar:

(16) Duratives Metarule

$\langle n, [\text{vp} \dots], F \rangle \rightarrow$
 -fin $\langle n, [\dots \text{DUR} \dots], \lambda x \text{DUR}'(F(x)) \rangle$

Tense Metarule

$\langle n, [\text{vp} \dots], F \rangle \rightarrow$
 -fin $\langle n, [\text{vp} \dots], \lambda x \text{PRES}'(F(x)) \rangle$
 +fin
 +pres

$\langle n, [\text{vp} \dots], \lambda x \text{PRET}'(F(x)) \rangle$
 +fin
 +pret

The Head Feature Convention (HFC) ensures that the feature [+pres] will be passed from the VP node to the lexical head of the VP constituent, the verb. The lexicon then provides possible forms for the feature bundles:

(17) verb e.g. verb
 -n (subcat. class) +2
 +pres (tense) +3per
 +x person +sing
 + singular

In the example here, these would include schlaeft, lacht, and existiert. The lexicon thus provides the correct morphological form in toto, leaving no work for late "spelling rules." This ensures that the proposal respects Brase's "spelling prohibition," and is consistent with the hypothesis of a limited interface between grammatical components.⁶

The thrust of this section, then: Tense would best be introduced by an operation on VP's.

4. Implications

By some lights, this is a surprising result. Since tense in German is marked morphologically, one is inclined (as noted above) toward a lexical treatment. Indeed, according to the Generalized Lexicalist Hypothesis (LaPointe (1980:230)), a lexical treatment of German tense is required, not merely desirable:

Generalized Lexicalist Hypothesis: No syntactic rule can refer to an element of morphological structure.

The GLH would allow lexical rules (LaPointe's "Lexically Restricted Frames") to refer to adjacent lexical items in syntactic trees, but would not allow them to refer to phrasal nodes such as the node dominating duratives. Any framework incorporating the GLH will therefore either eschew compositionality or will be committed to a level of structure between syntax and semantics.⁷

The Generalized Lexicalist Hypothesis is therefore incompatible with semantic compositionality (without the postulation of structure intermediate to syntax and semantic composition). It also points to a larger issue. The GLH codifies the view that there is no important distinction between derivational and inflectional morphology. This paper demonstrates the need—within semantically compositional frameworks—of reintroducing one important component of the inflectional/derivational distinction, viz. the need for syntactic rules to be able to refer to inflectional (but not derivational) morphology.

Rules such as those in (16) explicate two further remarks about the inflectional/derivational distinction which one often finds. First, note that the Tense rule assigns phrasal scope to the tense operators, which may be taken as a reflection of the sense that inflectional morphology is more closely linked to syntax than derivational morphology is. Second, note that the assignment of phrasal scope to these operators means that they

must be defined for an infinity of arguments—so that the semantic effects of attaching past tense morphology must be specified by rule, and not lexical item by idiosyncratic lexical item. The meaning of morphology introduced by such rules creates sets of items "alike in meaning" in that they differ quite regularly in meaning. I point out these further aspects of the treatment not to claim that they have been satisfactorily explained (since they certainly haven't been), but only to suggest that the sort of treatment proposed and justified here only for German tense might be of more general interest.⁸)

NOTES

1. The basic definitions implicit in (2) may be found in Nerbonne (1982) and, more completely, in Nerbonne (in progress).

2. Phrases whose internal structure are not of (immediate) interest are (mis-)represented as hyphenated compounds.

3. Stump (1981) presents an analysis of the English Perfect which could be used as the basis for a syntactic treatment of the relevant scope relationships.

4. This treatment of German is defended at length in Nerbonne (in progress).

5. An explanation of GPSG formalism may be found in Gazdar (1981) and Gazdar (1982). An explication of the tense logical operators 'PRES' and 'PRT', as these are realized in German, may be found in Nerbonne (in progress).

6. The fact that there are subconstituents within the VP which regularly exhibit tense marking (viz. verbs) may be felt to show that tense is therefore a verb category rather than a verb phrase category. It shows no such thing, however. The fact that tense marking is not on VPs, but on verbs, just as person and number marking is on verbs, does not prevent tense from having important ramifications beyond the verb, just as person and number marking does. This is agreement in the case of person and number marking and semantic scope in the case of tense. The HPC ensures that a feature required on VPs automatically make its way onto the word it is to mark. The HPC allows that tense may be introduced at the VP level (by MR) but realized as specific verb features (and ultimately, particular shapes of verbal stems). There is thus no discrepancy between the proposal that tense be accounted for via a VP MR and the existence of elements within the VP where tense marking is consistently realized.

7. LaPointe (1979) makes extensive reference to the well-formedness of representations at the level of "Logical Form." See e.g. his treatment of subject-verb agreement in English.

Logical Form, used in this fashion, constitutes a level of structure between syntax and semantic interpretation (as noted in the text).

8. LaPointe (this volume) proposes a revision of the GLH so that it would allow base syntactic rules to refer to morphology, but no others. Since the tensing rule must operate on entire VP's, it would seem to violate this constraint as well.

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